

JUL 2 1945

CANADIAN GEOGRAPHICAL JOURNAL

Vol. XXXI • No. 1

JULY 1945

PRICE 35¢





THE CANADIAN GEOGRAPHICAL SOCIETY

OTTAWA, CANADA



HONORARY PATRON

His Excellency Major-General the Earl of Athlone, K.G., P.C., G.C.B., G.M.M.G., G.C.V.O., D.S.O.

HONORARY PRESIDENTS

CHARLES CAMSELL, C.M.G., B.A., LL.D. and J. B. TYRRELL, M.A., LL.D., F.G.S.

BOARD OF DIRECTORS

CHARLES G. COWAN, President

Gen. A. G. L. McNAUGHTON, Vice-President
Hon. W. A. BUCHANAN, Vice-President
R. C. WALLACE, Vice-President

J. A. WILSON, Vice-President
O. M. BIGGAR, K.C., Honorary Counsel
K. G. CHIPMAN, Honorary Treasurer
E. S. MARTINDALE, Honorary Secretary

Hon. A. E. ARSENAULT, Assistant Judge, Supreme Court, Charlottetown, P.E.I.
MARIUS BARBEAU, National Museum of Canada, Ottawa.

ARTHUR BEAUCHESNE, Clerk of the House of Commons, Ottawa.

LAWRENCE J. BURFEE, Secretary for Canada, International Joint Commission, Ottawa

CHARLES CAMSELL, Deputy Minister, Department of Mines and Resources, Ottawa

Col. A. F. DUGUID, Director, Historical Section, Dept. of National Defence, Ottawa

Maj.-Gen. W. W. FOSTER, Vancouver, B.C.

AUGUSTIN FRIGON, General Manager, Canadian Broadcasting Corporation, Ottawa

K. A. GREENE, Ottawa

GILBERT LABINE, Toronto, Ont.

H. L. KEENLEYSIDE, Canadian Ambassador to Mexico.

F. C. C. LYNCH, Department of Mines and Resources, Ottawa.

B. R. MacKAY, Department of Mines and Resources, Ottawa.

Lt.-Col. L. T. MARTIN, Ottawa

Dean C. J. MACKENZIE, President of National Research Council, Ottawa

Lt.-Col. SIDNEY C. OLAND, Halifax, N.S.

F. H. PETERS, Surveyor-General of Canada, Ottawa

H. M. SNYDER, Sundre, Alta.

E. J. TARR, K.C., Winnipeg, Man.

GRIFFITH TAYLOR, University of Toronto, Toronto, Ont.

Hon. T. VIEN, Speaker of the Senate, Ottawa

J. C. WEBSTER, Shediac, N.B.

Editorial Committee

F. C. C. LYNCH, Ottawa, Chairman

F. D. L. SMITH, Toronto

Hon. W. A. BUCHANAN, Lethbridge

H. L. TRUEMAN, Ottawa

Hon. A. E. ARSENAULT, Charlottetown

Lt.-Col. G. L. P. GRANT-SUTTIE, Toronto

M. Y. WILLIAMS, Vancouver

D. C. HARVEY, Halifax

J. C. WEBSTER, Shediac

F. J. ALCOCK, Ottawa

GORDON M. DALLYN, Secretary

ROBERT ENGLAND, Sidney, B.C.

W. EGGLESTON, Ottawa

A. B. WATT, Edmonton

OLIVER MASTER, Ottawa

GEORGE W. BROWN, Toronto

R. I. C. STEAD, Ottawa

Executive Secretary and Editor

GORDON M. DALLYN

Auditors

Davis, Boyce & Company, Chartered Accountants



The Society's ambition is to make itself a real force in advancing geographical knowledge, and in disseminating information on the geography, resources and people of Canada. In short, its aim is to make Canada better known to Canadians and to the rest of the world.

As one of its major activities in carrying out its purpose, the Society publishes a monthly magazine, the Canadian Geographical Journal, which is devoted to every phase of geography—historical, physical and economic—first of Canada, then of the British Empire and of the other parts of the world in which Canada has special interest. It is the intention to publish articles in this magazine that will be

popular in character, easily read, well illustrated and educational to the young, as well as informative to the adult.

The Canadian Geographical Journal will be sent to each member of the Society in good standing. Membership in the Society is open to any one interested in geographical matters. The annual fee for membership is three dollars in Canada.

The Society has no political or other sectional associations, and is responsible only to its members. All money received is used in producing the Canadian Geographical Journal and in carrying on such other activities for the advancement of geographical knowledge as funds of the Society may permit.

CANADIAN GEOGRAPHICAL JOURNAL

Published monthly by
THE CANADIAN GEOGRAPHICAL SOCIETY
49 Metcalfe Street, Ottawa

Editor - GORDON M. DALLYN

This magazine is dedicated to the interpretation, in authentic and popular form, with extensive illustrations, of geography in its widest sense, first of Canada, then of the rest of the British Commonwealth and other parts of the world in which Canada has special interest.



The articles in this Journal are indexed in the *Reader's Guide to Periodical Literature* and the *Canadian Periodical Index* which may be found in any public library.

The British standard of spelling is adopted substantially as used by the Dominion Government and taught in most Canadian schools, the precise authority being the Oxford Dictionary as edited in 1936.

Address all communications regarding change of address, non-delivery of Journal, etc., to the publication office, 1,000 St. Antoine St., Montreal, Canada, giving old and new address. On all new memberships, the expiry date will be printed on wrapper containing starting number. This will constitute a receipt for subscription.

Membership in The Canadian Geographical Society is \$3.00 per year in Canada and other parts of the British Empire, which includes delivery of the Journal, postpaid; in United States, Mexico, France, Spain, Central and South America, \$3.50; in other countries, \$4.00. Make membership fee payable at par in Ottawa.

Member Audit Bureau of Circulations

SPECIAL REPRESENTATIVES:

Ontario and Quebec: F. A. DALLYN
Toronto office—21 King Street, E.
(Tel. EL. 2863)

Montreal office—1,000 St. Antoine
Street. (Tel. LA. 5566)

Europe: NORAH C. PERRY

5 Upper Dagnall Street, St. Albans,
Herts., England.

CONTENTS

JULY, 1945 + VOLUME XXXI + NUMBER 1

COVER SUBJECT:—*Parliament Buildings,
Ottawa, Canada*

NATIONAL FILM BOARD photo

	Page
CANADIAN PETROLEUM GOES "G.S."	2
by JOHN NESS	
PEAT IN CANADA	18
by A. A. SWINNERTON	
LAND USE POSSIBILITIES IN MACKENZIE DISTRICT, N.W.T.	30
by J. LEWIS ROBINSON	
JOHN CABOT OF BRISTOL	48
by LAWRENCE J. BURPEE	
CANADA'S CONTRIBUTION TO THE FOOD SUPPLY OF THE UNITED NATIONS	50
by A. E. RICHARDS	
EDITOR'S NOTE-BOOK	VII
AMONGST THE NEW BOOKS	IX



CONTENTS OF THIS JOURNAL ARE COPYRIGHT

ENTERED AS SECOND-CLASS MATTER AT THE POST OFFICE, MONTREAL, CANADA

PRINTED IN CANADA





Above:— Rotary drilling

*Right:— Unsung heroes in the battle
for oil—worn-out rotary fits*

Corsini photo, Courtesy Standard Oil Co.



Canadian Petroleum Goes "G.S."

By JOHN NESS

When the historians sit down to write the final analysis of World War Number Two, the chapter on petroleum should be illuminating.

In it they will probably tell how the Axis created a hydra-headed monster of aggression, of which oil was the life-blood, and may determine that a lack of petroleum reserves within Germany's own borders was one of the reasons why she embarked on her ambitious scheme of world domination.

In retrospect they may conclude that Germany turned away from a sorely-stricken Britain because of the need to replenish her dwindling reserves of oil by over-running Rumania and commencing her ill-starred attack on Russia, with the oil of the Caucasus and the Near East as a will-o-the-wisp, and how, foiled of easy conquest, her power to strike gradually waned and her doom was sealed.

On the other hand, they may credit petroleum with the salvation of the Allied cause; petroleum carried on the seven seas at the jeopardy of men and ships harrassed by, and for a time at the mercy of, submarine wolf-packs and questing dive-bombers. To the gradual rise and ultimate supremacy of Allied air-power; to the devastation of Germany's synthetic fuel manufacture; to the on-rush of mechanized armies tearing loose Germany's satellite oil-supplies, will surely be credited the ultimate victory, with petroleum, or the lack of it, tipping the scales.

As in the European theatre, so in the Pacific. Japan's first mad dash was directed towards the Netherlands East Indies and its treasures of oil, and to Burma with its less affluent but equally precious oil reserves: critical days—when American ships were

blazing pyres on the oceans, and Canada's northern oil reserves loomed as a possible bulwark against further disaster.

History will tell of the eventual damming of the yellow tide and the long, laborious road back; the slow, methodical island-hopping, and the bloody pitched battles of Saipan, Iwo and the Philippines; the reconquest of Burma and the naval cordon which allowed only a trickle of the oil for which she had gambled to reach Japan's fighting fronts. Here again, petroleum, or the lack of it, will be a determining factor in final victory.

Posterity will learn what we already should appreciate, that the United States was the Allied stock-pile of petroleum and its war-waging derivatives, both before and after Pearl Harbor: that until the Axis was driven from the Mediterranean and danger



The eyes of the geologist; core drilling in Alberta

to the oil supplies of the Near East was past, the oil industry of the States bled itself white to keep the planes flying and the wheels of essential industry turning, and that, in this effort, it was aided and abetted by the oil-producing Republics of South America, notwithstanding the desperate efforts of the Axis to cut off this supply near its source.

Yet, while the statistics of the United States' oil contribution to Allied victory may well dwarf comparison, it might not be out of place to throw a little light on the part which Canada played in this grim war of supply and demand.

Prior to 1939, Canada's latent petroleum resources were somewhat of an academic question, only tending to become controversial when some temporary recession of production in the United States, with a consequent rise in price per barrel, drew attention to the undoubted advantages of a more prolific domestic supply. There were those who, with oil in their veins, kept steadily plugging away on their wild-cat ventures, their scant successes doing little more than arousing a mild orgy of speculation and a brief period of intense, though sometimes misdirected activity, before the industry again relapsed into somnolence. Black Diamond, Fort Norman, Turner Valley, had at one time or another seemed the answer to the wild-catters' prayer, but, when the dogs of war were loosed, Fort Norman was, without undue exertion, taking care of the mining industry's needs in the Territories; Turner Valley had not long convinced the experts that it was more than a freak gas-field, and the oil being produced from the Prairies was negligible. The old fields of Ontario were a waning asset, and little or no oil was produced in the Maritimes.

That exploration was still being carried on was mainly due to the conviction of a few that Turner Valley could not be an isolated phenomenon, and that strata which nurtured a Skiff or a Red Coulee might ultimately beget a Signal Hill or an East Texas.

On this atmosphere of wishful thinking and intermittent effort, war's impact had

immediate repercussions; where production was established, it was exploited to the full, and where possibilities existed, they were explored to the limit. A few figures, representing Canada's entire output, will bear out the first premise.

<i>Year</i>	<i>Production</i>
1938.....	6,965,457 bbls.
1939.....	7,839,036
1940.....	8,719,882
1941.....	10,133,798
1942.....	10,410,446
1943.....	11,104,286
1944.....	10,171,305

Production, however, is only part of the story, for it does not show the intensive, fine-tooth combing which Western Canada has undergone in the interim, by every device and wile known to the oil-man, to determine the potentialities of the vast expanse of sedimentary rocks, seen and unseen, which underlie the plains and out-crop in the foothills.

The geologist with his little hammer and the wild-cat driller with his inadequate cable-tools and rusty casing, have given place to the mechanized army of the petroleum industry. One wonders what Dowling and Dingman would say if they could walk abroad on their old stamping ground and see what science and invention have brought to the aid of the oil-seeker, or what the sagacity of the one and the tenacity of the other might have accomplished had they been similarly equipped.

For not only the day-by-day emergencies of war, but the inroads which the prodigal demands of mechanized warfare have made over a period of years on the world's established petroleum reserves, have invested every sedimentary basin on the globe with new importance; and the extent, accessibility and petroliferous antecedents which Canada's western provinces can boast have made that region a happy hunting-ground for the oil-hungry, only surpassed, in the attention it is receiving, by some of the Republics of South America.

Where, perhaps for two decades, Imperial Oil carried the torch of exploration in solitary state as far as large corporations

were concerned, many of the major oil companies now have their scouts on the trail of development—their parties in the field and their rigs seeking the ultimate answer.

From the eastern borders of Saskatchewan, deep into Alberta's foothills and far into the Northwest Territories, every modern method of oil-finding is being employed. Aerial surveys have checker-boarded the less accessible ranges of the foothills; gravimetrical parties have reconnoitred great areas of the plains; the delicate finger of the seismograph has drawn profiles of hidden rock surfaces; core-drills have given the palaeontologist clues from which he may unravel the riddle of the sands; rotary tools have carried holes to unprecedented depths, and the full story of the drilling has been recorded by electric-logging; recalcitrant oil-horizons have been forced to disgorge their wealth by acidizing; even the tar sands have had some of their reputedly fabulous store squeezed out of them, but the pot of gold at the end of the rainbow still eludes the eager hands of the oil industry, and the clamant needs of Canada at war still remain unsatisfied.

It must not be thought that this entire effort has been abortive. Although certain areas have shown negative results, other areas—some of considerable extent—have proved productive, and a number of critical tests have aroused high hopes. The Alberta plains which produced 38,382 barrels in 1939, had stepped this up to 462,412 barrels in 1944, an increase which, in less hectic times, would be considered quite appreciable. In the same area a recent completion indicated the possibilities of production from the underlying Devonian, an event of great significance for, if such conditions are widespread, an immense new avenue of exploration will be opened up.

Those who have stoutly maintained that Turner Valley could not be an isolated island of production in an otherwise arid foothills belt, have had their faith rewarded and their hopes of eventual vindication restored by the Shell's deep test at Jumping Pound which, at 9,947 feet, gave indications



Drilling in "the land where the mountains are nameless".

N.F.B. photo

of duplicating the performance of Royalite No. 4 as a producer of naphtha-laden gas. If this, as in the Valley, indicates another "gas-cap", it is questionable if it will be exploited meanwhile, but feverish activity is taking place along the presumed flank of the structure, and soon the drills will be telling the story. As comparable structural conditions are presumed to extend both south and far to the north of Shell's discovery well, a decided fillip has been given to exploration, and areas which previous drilling had tended to condemn have been given a new lease of life.

A further impetus to exploratory drilling has been and is being given by the Dominion Government's policy of granting tax concessions against the expense of wild-cat wells. This inducement applies to the whole of Canada and, in general, amounts to 40 per cent of the drilling costs, although in the case of approved deep tests the exemp-

tion may be 50 per cent. Marginal drilling in the Turner Valley has also been encouraged by the Dominion sponsored "Wartime Oils", a company which assisted individual operators to develop acreage where, on account of the depth and uncertainty involved, drilling might not otherwise have been attempted.

The Turner Valley has borne the brunt of the demand on Canada's oil resources. The desperate need for production led to the virtual abandonment of the basic rules of conservation, and the field was produced at a higher rate than would have been countenanced under normal conditions. The result is apparent in diminishing yields and waning gas pressures, but that does not necessarily imply an ultimate loss, although it does suggest that the recoverable oil in the structure may be exhausted sooner, rather than later. It would, however, be premature to shed a tear for the Valley's departing glory, for recent developments have indicated a possible extension of the producing field and vital tests are in progress.

It would be a rash prophet who would foretell the future of the Athabaska tar sands, beloved of Ells.* Undoubtedly

*See "Research Touches the North", C.G.J. June, 1942.

"there's oil in them thar sands" and undoubtedly it will be extracted therefrom somehow, sometime, but apparently not in time to contribute much to Canada's effort in *this* war. So many problems are involved in extraction and treatment that it is wise to hasten slowly, even in the face of criticism, for the day may come when inventive genius will make recovery of oil from this source not only a feasible proposition but a lucrative one, which is more than can be said at the moment.

Canol was, admittedly, a war baby. Had the Japs established themselves firmly on the Aleutians, Fort Norman might well have been the hinge of a defence line for the American continent. Those who thoughtlessly condemn this project would do well to remember the very real danger which threatened—and which was only prevented from materializing by the foresight and prompt action of the Allies.

Canol, however, in a humble way, has contributed to the war effort in both hemispheres for its oil, piped to the refinery at Whitehorse, sped planes to our Russian allies on their long swing over the top of the world, as well as provided petrol for the patrol which kept Nippon at a distance.



Left:—Road building on The Smith Portage, long a transportation "bottle-neck" on the road to Fort Norman.

Right:—Pipe on its way to Whitehorse over the Alaska Highway

N.F.B. photos





Laying the Portland-Montreal pipeline, which saved many miles of hazardous ocean travel for oil tankers.



Fuelling a cruiser at sea, time being the essence of the contract.



Fuelling tanks for the morrow's battle.

Tremendous activity in exploration and exploitation has taken and is taking place; oil in undoubted quantity has been proven, the 58 producing wells already completed being considered indicative of a reserve of upwards of 30 million barrels and, in 1944, with restricted pipeline facilities, 1,149,469 barrels were shipped. The proximity of the field to the Alaska Highway and the certainty of increasing activity in mining, will always invest Mackenzie River oil with an important role in Canada's future economy; time and the drill alone will determine whether the Far North will produce in sufficient volume to warrant the enormous expense of taking its output to the centres of population.

Although no tangible results have yet accrued, Saskatchewan, during the war years, has seen an exploratory effort which has been widespread, intensive and expensive, a modest estimate of the cost running close to three million dollars. Geological parties, handicapped in their investigations by the heavy surface deposits which obscure bedrock over large areas of the province, have called the geophysicists to their aid. Gravimetrical crews have surveyed upwards of 20,790,000 acres; seismic surveys have covered 7,200,000 acres; core-drilling has been extensively utilized and ten deep tests, aggregating 60,395 feet, have been put down, with only a furtive indication of oil, here and there, to encourage further operations. Such, however, are the hazards of oil exploration.

As for the rest of Canada there is little over which to become enthusiastic: British Columbia records a few, unsuccessful wild-cat tests; in Ontario the shortage of natural gas for industrial uses has kept the drillers busy in an endeavour to augment that supply, little attention being given to the search for new oil pools; in the Maritimes a number of wells have tested widely scattered prospects, one off-shore effort being well on its way to establish a new depth record for the Dominion, but over all, the results have been negative.

In the light of the foregoing picture we can

only regret that greater success has not rewarded the effort to augment Canada's contribution to the Allied petroleum pool, but, fortunately, the supplying of raw material is only one aspect of the oil industry's war effort, and perhaps our self-esteem may be somewhat restored by a glance at what Canada has accomplished in other phases of the oil business.

Thanks to the initiative and foresight which had brought the Canadian refining industry to a high peak of perfection in pre-war days, it was ready to swing into an intensive effort at the drop of a hat, the only question being how best could it serve the country's needs.

The primary problem was not creative but quantitative, for the industry was already manufacturing practically all types of gasolines, fuel oils, lubricants, greases and asphalts which were essential to war production and the armed forces, but in totally inadequate volume for the abnormal demand which immediately arose. Perhaps the greatest contribution the oil industry made to Canada's war effort was the manner in which its chemists and engineers overcame the many difficulties which stood in the way, and increased the output of manufactured products by millions of barrels, while yet keeping to a minimum the demand for manpower and vital materials necessary to construction and conversion.

On the outbreak of hostilities the first demand was for high-octane aviation gasoline, but when it was appreciated that to manufacture 100 octane in the required quantities would entail the construction of costly refinery units and consume valuable time, it was decided to utilize 87 octane as the fuel for aircraft under the British Commonwealth Air Training Plan, and all available refinery capacity was devoted to that purpose. As a consequence sufficient quantities of suitable gasolines were provided to meet the training schedules of air personnel, and the man-for-man superiority which Commonwealth graduates established over their foes may be credited, at least in part, to the fact that each pilot burned, on

an average, 4,500 gallons of gas before getting his wings.

The demand for asphalt, due to the rapid expansion of training stations under the Commonwealth scheme, was also immediate and clamant. The pre-war experience of the oil companies in road-building and soil analysis was invaluable in curtailing costs and ensuring durability, while the refineries co-operated by supplying the wherewithal to surface 10 million square yards of runway in the first year of war.

So too, the insatiable maw of the navy and mercantile marine called for unbelievable quantities of fuel oil; (a warship will take up to 700,000 gallon of bunker fuel at one filling); tractors, trucks and tanks cried aloud for diesel fuel; essential industry demanded fuel oils of all kinds and lubricants of every sort and in no small measure. By juggling available equipment and by major changes in refinery operations, every requirement was met and every emergency was overcome as it arose, with gasoline rationing of the individual motorist as a by-product.

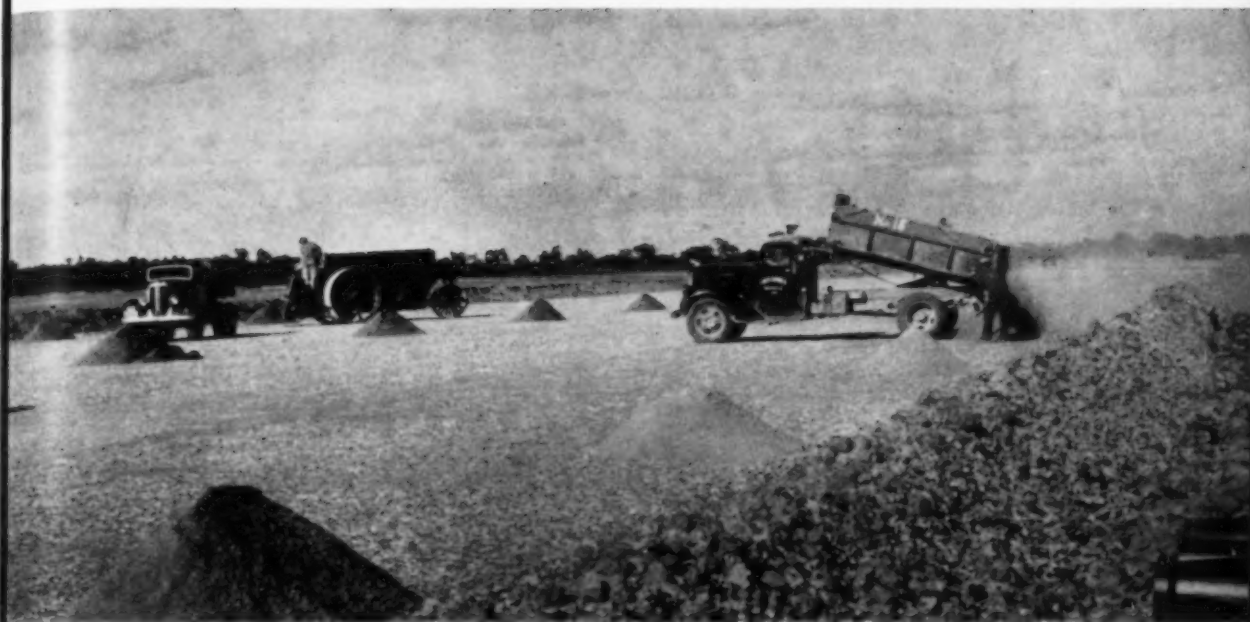
It was in such a manner that the oil industry catered to what might be called the basic needs of the country, the supplying

of certain well-defined products which were standard items of manufacture, the only problem being the stepping-up of output to unprecedented proportions. But as the war ran its course new weapons of offence and defence were forged; the "mother of invention" evolved variations and improvements on existing engines of destruction; global warfare demanded refinements in essential supplies to cope with climatic vagaries from the Tropics to the Arctic; the loss of vital raw material called for exploration and exploitation in the synthetic field and, in practically every instance, the success of such ventures depended on the ability of petroleum technologists to be just a jump ahead of their opposite numbers in the aeronautic, engineering and chemical fields.

Here again the high attainment of the pre-war refining industry had more or less anticipated such developments. In the case of lubricants, for instance, the solvent extraction and solvent dewaxing processes, so necessary for the production of high quality oils, had been already developed after long and painstaking laboratory research, and it only required an effort of production to meet the demand, especially for those lubricants

The final destination of high-octane gasoline





The Commonwealth Air Training Plan called for air-fields from coast to coast.

required for the abnormalities of aviation engines.

Solvent dewaxing is, broadly, a method of removing wax from raw lubricating oil, and solvent extraction is designed to eliminate other harmful and unstable compounds.

Catalytic suspensoid cracking, a heat-pressure process which converts heavy oils largely into gas, was another pre-war infant prodigy which did not belie its early promise. From its original role of producing high-octane cracked gasoline, it was rapidly developed into the catalytic super-suspensoid cracking process from which are obtained the hydrocarbon gases for synthetic rubber polymers.

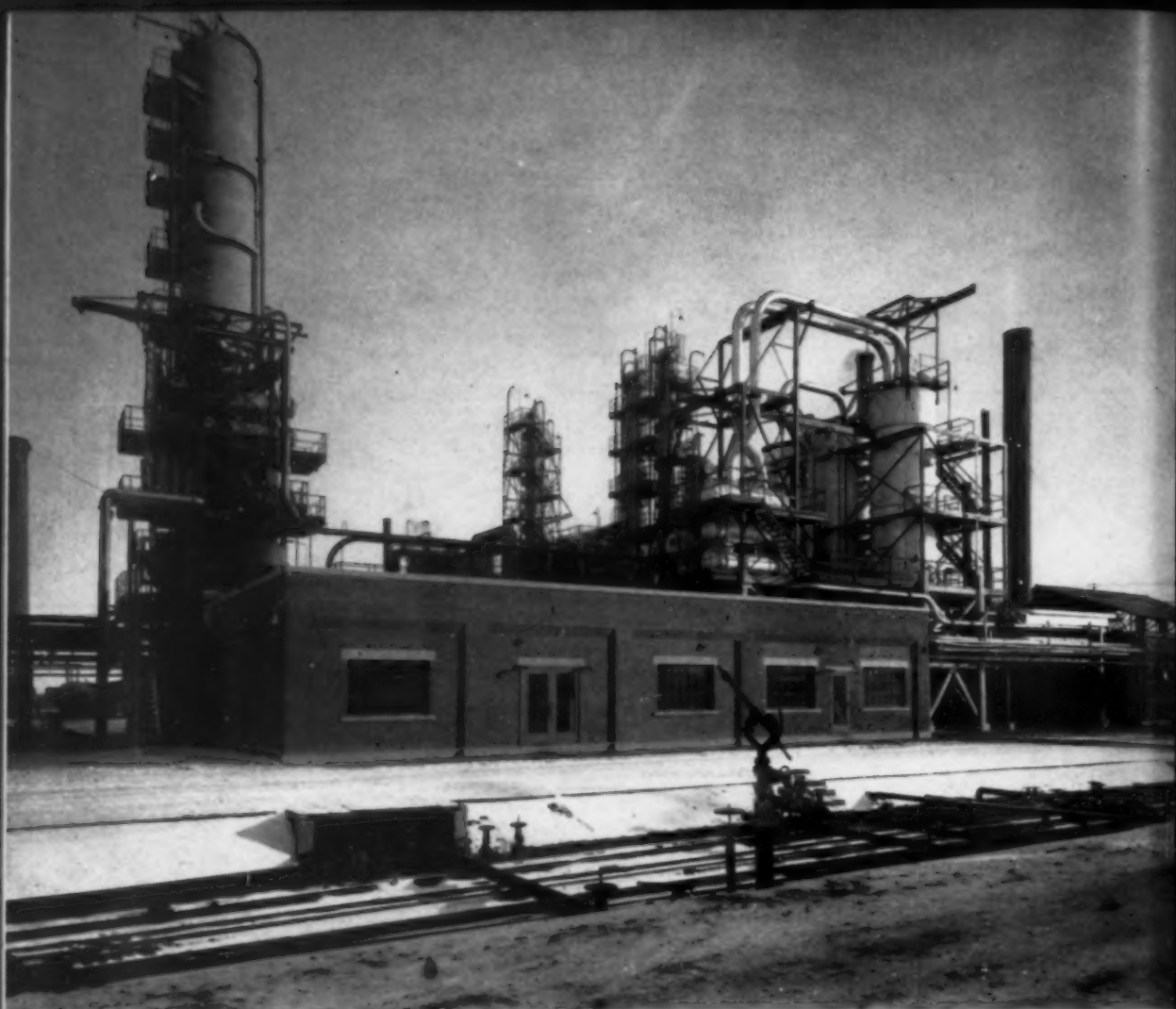
The changing fortunes of war emphasized first one and then another aspect of the oil industry's contribution to victory; at one time air-fields and storage facilities on the eastern sea-board and Newfoundland were the crying need, and prodigies of transportation and construction saved the day. As rapidly the scene shifted west, and it was along the Alaska Highway that tankage had to be erected at short notice to serve the Northwest Staging Route between Edmonton and Whitehorse.

This development was not without its interludes. Being fairly small, the fuel tanks

for all stations except Whitehorse were prefabricated, taken to Edmonton by rail, and hauled over the Highway by truck. The plates for the Whitehorse tanks were shipped by water from Vancouver to Skagway and thence carried over the White Pass. The reinforcing steel was flown in from Edmonton, and one such load—three tons—destined for Fort Nelson, had a rough passage. After lying at Edmonton for three weeks, a plane was made available, but, after covering the 700 miles to its destination, the weather at Fort Nelson prevented landing, and the plane went on to Whitehorse—a further 500 miles. There the steel was unloaded to await transport, but again the weather at Nelson was unfavourable,



Refining is an exact science.

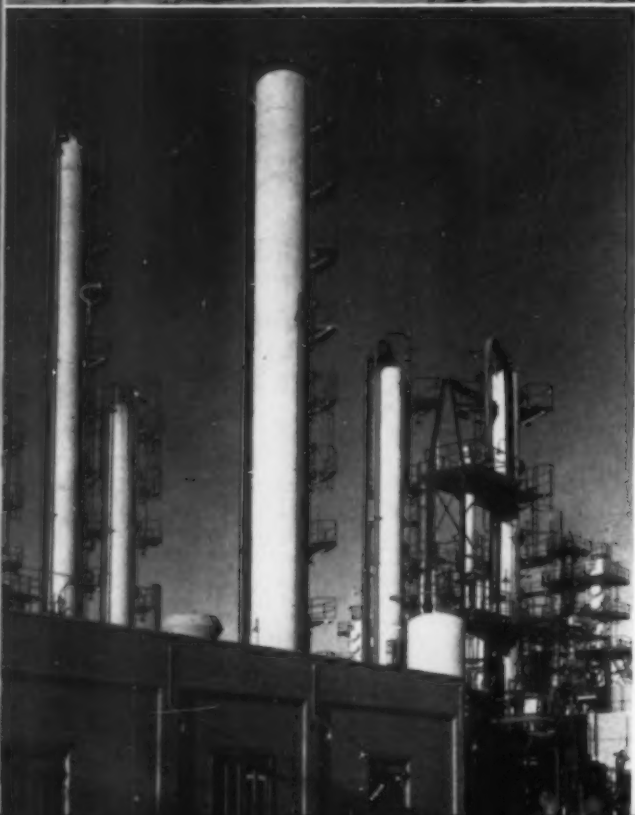


Above: — Refinery capacities were expanded at Calgary.

Left: — Alkylation plant at Calgary

Top right: — Fighting the battle of priorities. "B.A." construction at Clarkson

Roseborough & Rice photo





and the steel came all the way back to Edmonton, eventually securing shipping space and a happy landing at the third attempt.

Tanks were put underground, and excavation was not too difficult even in winter as the sites were in bush country. The laying of pipelines in the open was another story, for bull-dozers and pavement-breakers wore themselves out on the frozen ground, and it required blasting and the heaviest make of bull-dozer to ultimately make the excavations.

The winter of 1942-43 created something of a record, temperatures of 68° F. below being recorded. Pouring concrete under such conditions was a problem, and a 75-foot circus tent was flown in from Vancouver and erected over the site. Inside the tent ten

stoves, made from oil drums and wood fired, kept the temperature at 90° F. above, whereas outside it was 45° F. below. For every man pouring concrete there were two sawing wood.

Fortunately necessary construction did not always have to cope with such conditions. The British American Oil Co. built a new refinery at Clarkson, on the shores of Lake Ontario, adding considerably to the output of aviation gasoline and lubricants; a Californian refinery was dismantled and shipped piecemeal to the Yukon, where it was erected and operated by Standard of California for the American military command; Imperial Oil Ltd. largely augmented its facilities at Regina, Calgary and Sarnia, at the last mentioned centre making provision for the needs of synthetic rubber

manufacture; the Shell installations at Montreal were also enlarged by an alkylation unit.

The twins which put the ultimate "oomph" into 100 octane, fighting-grade, aviation gasoline are alkylate and cumene. At Shell's Montreal refinery and Imperial's Calgary installation, alkylation plants convert petroleum gases into alkylate. Cumene is made by the Dow Chemical Co., operating units of the Polymer Corporation at Sarnia, where a retired cracking coil at Imperial's refinery has been revamped for this purpose. The Shell and McColl Frontenac refineries at Montreal also manufacture cumene, which is a combination of propylene from refinery gases and benzene, a coal product.

Coming closer to earth we find a fascinating side-light on petroleum's war-effort in "P.B.S." (Prefabricated Bituminous Surfacing)—the *multum in parvo* air-field.

We have all seen enough of permanent air-field construction to appreciate the time, material and effort involved but, when armies are driving ahead, there is neither time nor opportunity to lay down such runways. The nearer to the front line the strafing and fighting planes can land and take off, the greater their value to the attack, and there was an insistent call for a non-permanent, but quickly assembled air-strip, which would ensure immediate and close air support to advancing troops.

Time being the essence of the contract, the first answer of the military engineer was merely to utilize more men, more machines and more material, but that plan had serious limitations, and effort was directed to evolving some type of prefabricated surface or some method of rapid surfacing. Prefabricated steel net-works and steel tracks of various types were tried, the most effective being the "pierced steel plank", but all of these were at the mercy of the weather, as soggy foundations resulted in the steel reinforcing going out of shape and becoming, in some cases, entirely submerged. A further drawback was the immense tonnage of valuable steel required.

Experiments in Britain favoured grading and compacting the natural surface and applying a waterproof covering by first spraying with bitumen and then spreading on it a cotton fabric, treated subsequently with one or more bitumen coats.

(It is interesting to learn that Imperial Oil, in conjunction with the Quebec textile industry, constructed a stretch of road in Drummondville by this same method.)

While giving satisfactory results as far as the runways were concerned, the drawback to this plan was the necessity for transporting large quantities of bitumen into the field, together with the machinery for melting and spraying.

Prefabricated bituminous surfacing (P.B.S.) evolved from the Department of Asphalt Technology of Imperial Oil, and particularly from the fertile brain of Mr. Charles Baskin. He suggested that whatever fabric was put into use should be saturated and coated with the necessary bitumen in a manufacturing plant, taken to the field in rolls and there spread out, overlapped and stuck together by the use of a solvent which would make the bitumen adhesive. Having proved perfect in practice, this type of air-strip is to be found wherever the Allied armies are engaged, whether it be on the holy soil of Hitler's Reich, or the trackless jungles and mountains of the Far East. Before this fracas ends we may see an airman calmly parachuting earthward with a roll of P.B.S. under his arm and nonchalantly laying a runway so that his pilot may follow him in.

Much of the oil industry's success in meeting the demands put upon it has been due to the planning of the Associate Petroleum Committee of the National Research Council, made up of technical representatives of the industry and personnel of the Navy, Army, Air Force and Government departments; that petroleum has been an effective weapon for victory reflects the highest credit on that body. In like manner the development of P.B.S. owed much to Brigadier Storms of the R.C.E., Major Gordon McIntyre, attached to Canadian

Military Headquarters in London; General McNaughton, the then Commander-in-Chief; the British Research Laboratory and Ministry of Supply. The days of the famous, or infamous, "Col. Blimp" are long past.

Having admitted the inadequacy of domestic crude to make more than a ripple on the surface of the vast petroleum stream which has surged through our refineries in the war years, it is only courteous to acknowledge the Good Neighbour Policy which has kept the pot boiling to the average tune of some 48 million barrels annually. The United States has, of course, been the big factor and possibly over 60 per cent of our entire crude imports have come from that source. Colombia, Venezuela, Peru and Ecuador have contributed the remainder, their quotas varying according to prevailing conditions. To preserve the price ceilings for petroleum products in Canada, the Dominion Government has borne part of the excessive costs of transportation imposed by war risks—total subsidies, for this purpose only, amounting to 37.7 million dollars.

It is perhaps fitting that the final chapter of "Petroleum at War" should deal with its "Silent Service", the men who go down to the sea in oil-tankers—those ships which are not only the eagerly sought prey of the enemy but also carry their own destruction as cargo.

At the outbreak of war Imperial Oil, as the only Canadian company operating a fleet on ocean and coastwise service, was asked to re-route its ships overseas and to man and operate a further fleet of tankers flying the flag of Panama.

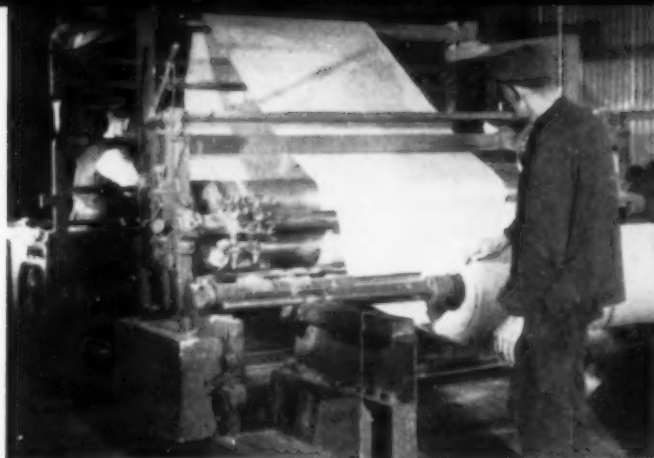
Top to bottom:—

P.B.S. in the factory

Impregnated P.B.S. fabric prepared for shipping.

The final stage in P.B.S. air-strip construction; bonding the seams.

Laying an air-strip with P.B.S.





One reason why lubrication is a problem.

Taking on cargo at their customary ports, these ships now sailed to Southampton and LeHavre with crude for the refineries at Fawley and Gerome respectively. Occasionally they braved the Mediterranean to load at the terminal of the Iraq pipeline and, ever and anon, they ventured into still more distant seas.

At the fall of France the *Calgarolite* was the last ship to leave Le Havre, under a rain of German bombs, leaving her consort, the *Joseph Seep*, a flaming hulk in that harbour. Imperial tankers plied the Atlantic in the most tragic phase of the submarine war; the *Tronolite*, travelling in convoy with a deadly cargo of casinghead, saw four ships go down around her, but remained unscathed. The *Canadalite*, labouring out of Freetown at reduced speed because time was too precious to spend in dry-dock, fell an easy prey to a German raider and was sailed to Bordeaux under a prize crew, her complement headed for a German prison.

Pearl Harbour and the entry of the United States into the war sent the Imperial fleet back to its accustomed sea-routes but into greater danger, for the German wolf-

packs concentrated on the coastwise shipping lanes and three vessels went to Davy Jones in turn. Not a soul survived from the *Victolite*; the survivors of the *Montrolite* spent three days in open boats in the bitter storms of the Atlantic before being picked up; fortunately there was no loss of life in the *Calgarolite* sinking.

Neither have the shore staffs of the industry's shipping service been idle for they have assisted various departments of the Government in the designing, operating and building of various types of nautical craft.

In spite of the tremendous claims made upon the petroleum industry and the staggering figures which represent its cumulative war-effort, the personnel of the oil companies has not been slow to answer the call to arms. The Air Force seemed to appeal especially to men who had dabbled in oil in civilian life; technical men joined units where their special training could be used to advantage; hundreds more were content to be numbered with the unsung heroes who just march, and march, and march. To-day, the industry is well-advanced in plans to rehabilitate its returning men.

CANADIAN PETROLEUM GOES "G.S."

It is axiomatic that the very wastefulness and destruction of armed conflict gives a fillip to peace-time progress, and the petroleum industry has sired numerous war babies who will have no small influence on the future comfort and convenience of mankind.

It used to be said that the improvement of automobile engines was retarded by the lack of suitable fuels, but the development of catalytic cracking processes, primarily for the production of gaseous hydrocarbons for Canada's rubber project, will, with modifications, ensure highly efficient motor gasolines for engines hardly yet in the blue-print stage.

Post-war lubrication will undoubtedly benefit because of the many specialized products demanded by the Air Force, and road construction will have at its command an improved technique in the use of asphalt.

At the behest of the Department of Munitions and Supply, the Ordnance Department and the R.C.A.F., many special oils and greases were manufactured to meet extremes of heat and cold or to withstand excessive load conditions, and peacetime transportation will, thereby, run all the more smoothly.

Finally, if half of the wonders anticipated from the use of plastics and synthetics ever materialize, the oil industry will be the silk hat from which chemists will conjure a bewildering assortment of rabbits for "Babbits".

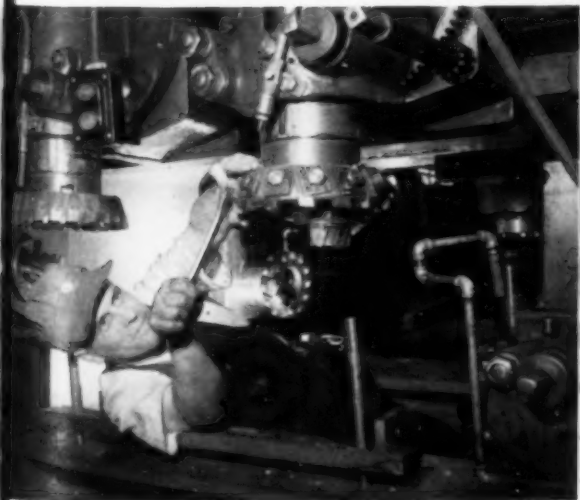
Proudly wearing the "G.S." badge in wartime, Canada's petroleum industry will still be on "General Service" in the day, hailed by the poet,

"When wild war's deadly blast was blawn,
And gentle peace returning".

Right:—Special oils for special jobs

Bottom right:—Greasing the slips for yet another corvette.

Below:—War industries demand lubrication.





**High moor peat bog—St. Charles*

Peat in Canada

by A. A. SWINNERTON

THE word peat probably conveys to most people the idea of a fuel, and relatively few are aware of the existence and uses of another form of peat known as peat moss. This is the name used in the trade for dead, fibrous moss that has been excavated from peat bogs, dried, shredded, and pressed into bales or smaller packages. Its value depends on its highly absorptive nature, and its main uses are, in agriculture, for stable bedding and poultry litter, and, in horticulture, for soil conditioning and as a filler for commercial fertilizers. It is also used for insulating and as a packing material.

The value of peat moss has long been recognized in Europe, where it is widely used, but in spite of the existence in Canada of deposits comparable with the largest in Europe, it has as yet found little use in this country.

In the United States, however, its value is being increasingly realized and the quantity

imported from Europe increased from 5,000 tons in 1924 to 78,000 tons in 1939. When supplies from Europe were cut off as a result of the war, active attention was given to the development of the deposits in Canada, with the result that, in 1943, over 60,000 tons were produced, most of which was exported to the United States.

PEAT IN GENERAL

Definition: The origin of the name peat is obscure, but it is supposed to be of north German or Anglo-Saxon extraction from a word signifying bog or pond. The term peat bog is a general one applied to deposits of plant materials that have accumulated in lakes, ponds, marshes, and swamps. These deposits are formed in areas where a lack of drainage and consequent lack of aeration permits an accumulation of organic acids.

Formation and Origin: The formation of peat is dependent upon a special combination of climatic and topographical conditions.

*Courtesy of Quebec Department of Mines



Low moor bog—St. André

The principal factors are:

1. An adequate supply of rainfall and surface water.
2. Growth of aquatic and moisture-loving plants.
3. A soil or subsoil that will retain water at the surface.
4. A sufficiently humid atmosphere to prevent too rapid evaporation.
5. A temperature high enough to allow a profuse growth of vegetation, yet low enough to check too rapid a decay of vegetable matter.

These conditions are more generally found in countries having temperate or cold climates, consequently the southerly portion of Canada and the northerly portions of the United States contain the most extensive deposits of peat on this continent.

The rate of growth of peat bogs is naturally slow and varies from a few inches to two or three feet per century.

Composition: Peat in its natural state consists of about 90 per cent water and 10 per cent of partly decomposed and disintegrated vegetable matter. Though many varieties of plants are found in peat bogs, the bulk of the material has been supplied by a comparatively few varieties. Chief among the peat-forming plants are the mosses such as sphagnum and hypnum, marsh and heath plants, grasses, sedges, water plants and algae, etc. Sometimes the

roots, trunks, and leaves of trees are also found.

The plant varieties forming the successive layers of a peat bog reflect the climatic conditions and topographic features of the bog. Changing conditions during the life of the bog cause changes in the growth and composition of the plant communities, and, as a result, successive layers in a peat bog may be composed of the remains of different plant communities and therefore possess different characteristics.

A vertical section of an ideal peat bog would show the following strata:

1. A bed 6-12 inches thick of living sphagnum mosses, overlying 6-10 feet of unhumified dead moss, which is known as peat moss.
2. A bed of well humified woody peat containing partly decomposed stumps and roots.
3. Beds of reed or sedge peat formed by the humification of reed or sedge plants.
4. Finally, a layer of dark jelly-like ooze, sometimes called sedimentary peat, resting on a clay or silty bottom.

There is, of course, considerable variation in the composition of different peat bogs, according to the climatic or other conditions under which they were formed, and not all bogs contain all the varieties of peat described above.

Top to bottom:—

*Peat fuel machine—St. Jean

*Excavating fuel peat by hand—Grondines.

*Excavating fuel peat by dragline—Bagotville.

*Fuel peat machine in operation—St. Bernard



Above: Fuel peat being extruded on pallets—St. Jean.

Generally speaking, humification increases from the top to the bottom of the bog, but this is not universal as, in some bogs, well humified material overlies less decomposed vegetation.

Extent and Distribution: Peat is widely distributed in Canada and is found in every province. According to an estimate made several years ago, there are at least 37,000 square miles of peat bogs distributed as follows:

Province	Square miles	Average depth in feet
Nova Scotia	250	8 to 10
Prince Edward Island	10	8 to 10
New Brunswick	250	8 to 10
Quebec (in settled parts)	500	8 to 10
Ontario (in settled parts)	450	5 to 8
Ontario (Moose River Basin, etc.)	10,000	5 to 8
Manitoba	500	6 to 10
Alberta, Saskatchewan and Territories	25,000	5 to 10
British Columbia and Yukon Territory		(no exact data)

Of this total area only a small portion is likely, at the present time, or in the near future, to be utilized.

FUEL PEAT

Many attempts have been made during the last forty years to develop a fuel peat industry in Central Canada, but without success. The most important experimental work was that conducted by the Peat Com-



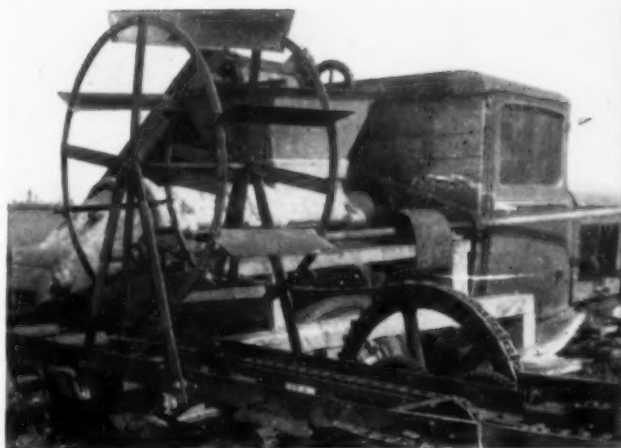
Above: Building drying racks—St. Jean.

mittee at Alfred, Ontario, between 1919 and 1923, when, during the investigation, between 16,000 and 17,000 tons of peat were made. Since that time small quantities have been made intermittently in Ontario and Quebec for local use.

In 1943, owing to an expected shortage of wood fuel in the Province of Quebec, there was a renewed interest in peat fuel, and, with the co-operation of the Emergency Coal Production Board, a start was made in the manufacture of machine peat on a small scale. The Quebec Department of Mines had developed a portable macerating machine which called for the minimum of equipment and only ordinary labour for operation, and a number of these machines were made available to a selected number of operators. Ten operations were in progress during the summer at different localities in the province and about 1,500 tons of peat were made.

Description of Peat Machine and Method of Operation: The peat macerating machine developed by the Quebec Department of Mines is derived from the Dolberg machine, which was largely used in Europe. Briefly, it consists of two intermeshing worms—one right-handed and the other left-handed—about eight inches in diameter and 30 inches long, enclosed in a cast iron casing provided with a feed hopper at one end and a delivery

*Top to bottom:—
*Fuel peat drying on racks—Grondines.
*Fuel peat drying on racks—St. Bernard.
Peat machine with power-driven conveyor—St. André
Close-up of peat machine and conveyor—St. André*





**Peat fuel drying on ground—St. Charles.*



**Fuel peat being taken to drying area by tractor—St. Jean.*

spout at the other. This unit is mounted, lengthwise, on the chassis of an automobile that has been stripped down to the framework, behind the front seat. A belt pulley is attached to an extension of the main shaft of the engine, and this, through a belt, drives a countershaft which extends backwards over the running-board to drive the macerator and elevator gear. Hinged to the hopper is a light, chain feed conveyor 10-12 feet long which can be raised or lowered into the excavation as desired. The delivery spout of the macerator has three openings 3 in. x 3 in., side by side, with half-inch walls between the openings; in operation, therefore, three

parallel streams of peat pulp 3 in. x 3 in. and half an inch apart are extruded and received on wooden pallets, made of laths, three feet long and one foot wide. These pallets are supported on a light stationary conveyor made up of wooden rollers 3 inches in diameter and 12 inches long, spaced 10 inches apart and held together in a frame.

Before it can be used as fuel the peat has to be dried down to about 25 per cent moisture content (as it comes from the machine its moisture content is about 80 per cent). This drying is accomplished either by placing the pallets in racks holding about 150 pallets or by laying them out on the surface of the bog to air dry. As it is necessary to economize on labour, the pallets are taken to the drying area either by means of a power-operated conveyor driven off the macerator unit, or loaded into sleds and hauled to the drying area by a caterpillar tractor.

As a result of the experimental work carried out in 1943, it was confidently expected that a substantial amount of peat fuel would be produced in 1944. Owing to the lack of any apparent market that year, however, these hopes were not realized, only two operators were engaged in making fuel peat, and their total production amounted to less than 200 tons.

PEAT MOSS

As already described, peat occurs in nature in two distinct forms, unhumified and humified.

Unhumified peat or peat moss is the dead moss of the sphagnum plants. Their peculiar mode of growth, increasing the length of the



**Roll conveyor—St. Charles*



**Fuel peat drying on pallets—St. Bernard.*



**Fuel peat on sled—St. Jean*

stems upward year after year, while dying at the roots, perpetuates their existence and raises the surface of the bog of which they form a part.

Peat moss is fibrous, elastic, light in colour, and possesses the valuable property of being able to absorb and hold from 10 to 26 times its own weight of liquids. Unhumified peat left in the natural state will humify in course of time and all fibrous matter will gradually disappear.

Moss Peat Manufacture: In selecting a deposit of peat moss for development, the following points should be noted.

1. It must contain a sufficient amount of sphagnum moss of good quality with a minimum depth of four feet.
2. It must be capable of being easily and inexpensively drained.
3. The climatic conditions must be suitable for drying the peat to the required degree.
4. The site should be close to existing transportation facilities and not too far from the market.
5. Adequate working capital must be available as drainage and cutting must be done from one to two years in advance of manufacture and sale.

In addition, of course, good management is just as necessary in this as in any other business.

*Right:—*Air-dried fuel peat—St. Charles*

Below:—Stack of peat fuel—St. Jean

The first operation in the preparation of a peat deposit for commercial utilization is drainage. Good drainage is important not only for removing the excess water contained in the peat materials but also for producing a firm working surface. The drainage system, which consists of main and lateral ditches, should be adequate to remove any excess of water following a heavy rainfall without resulting in too great a lowering of the water table. It is not desirable to drain the entire bog at the start, the drainage work should be kept at least two years ahead of the cutting so that the peat will be in the right condition for excavation.





Left: Floral moss drying on screens—Bagotville.

**Below: Floral moss on drying screens—St. Marc*

**Centre left: Floral moss drying on ground—St. Marc.*



**Left: Vegetation on peat bog—St. André*

Right: Unloading floral moss at baling shed—Bagotville.





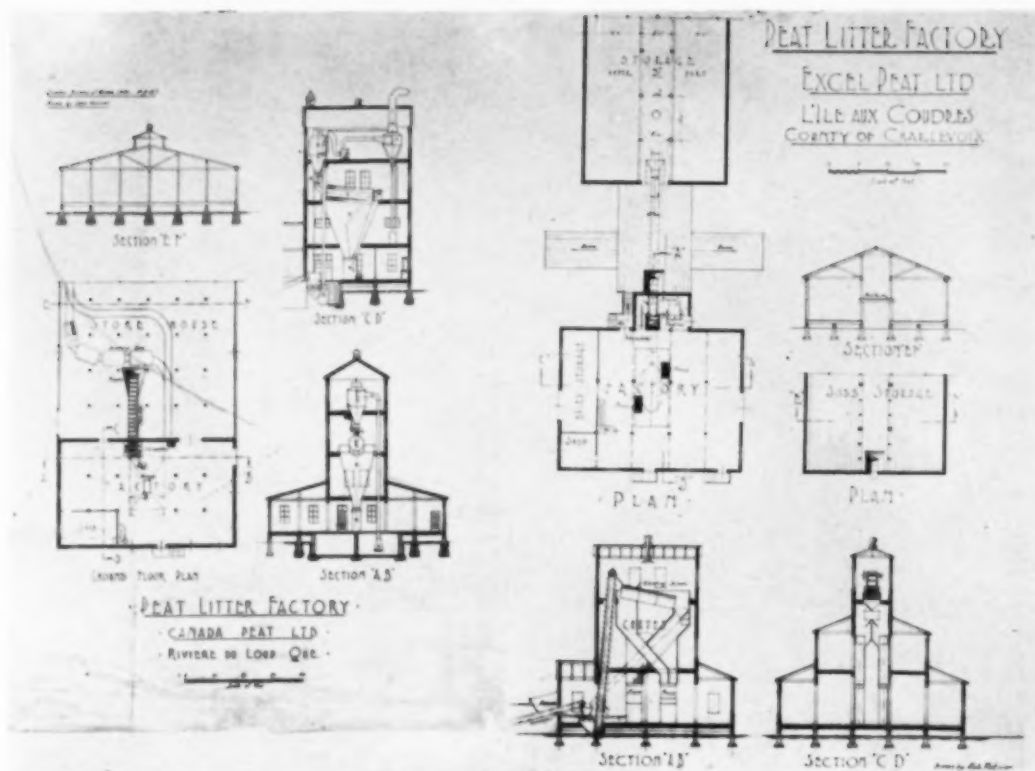
Excavating peat moss—Isle aux Coudres.

The peat is excavated by hand to a depth of about four feet, using specially shaped shovels and the blocks are first piled alongside the excavation, then, after a few days, either piled in heaps or placed on wooden racks to dry out. In Eastern Canada, it has been found advisable to let the partially dried peat remain in the field all winter, as the frost bursts the plant tissues and thereby makes a more absorptive peat. In addition, the partially dried peat blocks thawing out in the spring benefit from the favourable drying conditions during the months of April and May with their prevailing high winds of low relative humidity. This procedure, however, cannot be followed on the bogs in British Columbia as, in the Fraser delta, there is virtually no frost, and, after the middle of September, when the rains start, the atmosphere remains humid all winter. The partly dried peat blocks, having no protective frozen surface, absorb water and by the spring have become as wet as they were when they were excavated. Consequently, in the Fraser valley, all the season's cut must be under cover by the middle of September.

The dried peat is brought to the mill either by tractor-drawn sleds, in cars running on a light railway or by belt conveyor, depending on the system in use at the bog. After arriving at the mill, it either goes to the storage shed or direct to the shredding machines. These shredding machines consist



Peat moss drying on stakes—St. Anaclet.



*Peat litter factory—diagram

essentially of two drums, provided with teeth or knives, rotating against each other at different speeds, which can be adjusted so as to disintegrate the peat blocks into any desired size. A bucket elevator carries the shredded material to rotary screens, where it is separated into three sizes, the coarse for use as stable litter, the medium for poultry and small animal litter, and the finest material, usually termed peat mull, for soil conditioning, packing and insulating material.

After shredding, the material is air cleaned in order to obtain a non-dusty stable and pen litter. Each size of screened material is taken by conveyor to its respective storage bin placed above a press in which it is pressed to bales weighing from 100 to 150 pounds. The bales are covered with burlap or heavy paper and held together with laths and wire. An alternative method is packing in heavy fibre-board containers

holding approximately 100 pounds. The bales and boxes are then sent to the warehouse or loaded directly into cars for shipment.

A peat moss factory requires a large force of labour, chiefly for digging and drainage work, etc., but, as the baling plant can operate during the winter, a large proportion of the labour can have year round employment.

Uses for Peat Moss: The most noticeable properties of peat moss are its high absorptive capacity for liquids and gases, resistance to decomposition and low heat conductivity. For these reasons it makes an excellent stable litter for horses and cattle, and is of special value for poultry litter. Although not a fertilizer in itself it makes a valuable soil conditioner; and it is also used in the building trade as an insulator for heat and sound.

For stable and pen bedding, one ton of peat moss litter serves as long as two and a

half tons of straw; work in the stables is lightened, and less storage space is needed. The animals rest on a warm, clean and dry bed, and so less grooming is needed because the bedding can easily be kept dry and clean if only the damp parts be removed and replaced by fresh litter moss. Such bedding lasts a month before an entire change is necessary. Peat moss absorbs the nitrogen and retains the valuable constituents in the animals' droppings. Gases such as carbonic acid, ammonia, and offensive odours are absorbed in the moss, and the sanitary conditions in the stables are improved for the employees and the animals. Peat moss manure is a valuable fertilizer, and, as it commands a much higher price than straw manure, is a source of extra revenue to the user of moss litter bedding.

Peat moss is of special value to poultry breeders, because, in addition to its absorptive qualities, it retards bacterial growth, and lice, mice, and other vermin do not thrive in it. It is claimed that the flock will be healthier with fewer of those losses, through sickness and death, so prevalent in poultry raising, and healthier birds naturally produce more eggs and put on weight, and the quality of the poultry meat is improved.

Shippers find peat moss an excellent packing material for certain perishable goods such as fruit and vegetables, and, as it is one of Nature's best heat-insulating materials, it protects them against frost in

winter, or, if they are chilled in summer, they keep cool for an appreciable time. The present shortage of paper could be relieved, to a certain extent, if peat moss were used more widely as packing material. It forms an ideal packing for overseas shipment of articles that absorb moisture, fragile goods such as glass and crockery, and roots, bulbs, etc. Ordinary packing material is a nuisance to the recipient, a fire hazard if kept, and irksome to dispose of, but peat moss, owing to its many uses, would be a welcome by-product to the receiver of goods in many cases.

Horticulturists already recognize the advantages of the use of peat moss; they get better lawns, more luxuriant flowers and stronger and more advanced plants and shrubs; they use it as a packing material in the shipment of flowers, shrubs and tubers, in making compost, and as a diluent in the application of artificial fertilizers, which otherwise are likely to "burn" the plant.

Although there are many insulating materials on the market, peat moss is used in the building trade for insulation and for sound-proofing. It is not a fireproof material, but does not easily ignite, and, by impregnation with chemicals, it can be made to conform to civic building regulations.

Sphagnum peat moss, especially when mixed with fibrous cotton-grass peat specially treated, makes a very efficient surgical dressing. It was used extensively during the World War 1914-1918 by the Allies and the

Baling shredded peat moss

Loading baled peat moss





Left: Loading dried moss on to trucks—Welland.

Below: Loading cars on field railway—Welland.



Central Powers. On account of their exceptional absorbent, deodorant, and antiseptic qualities, the sphagnum surgical pads were found to be an excellent substitute for absorbent cotton.

Finally, one of its most important recent uses has been in the production of metallic magnesium.

Production: Prior to the war, peat moss was obtained from bogs at Isle Verte, Rivière Ouelle, and Waterville in Quebec; at Grand Valley and Clinton in Ontario; at Edmonton West in Alberta; and at New Westminster in British Columbia. It was used as a bedding litter for animals, as a filler for fertilizers, for insulating and sound-proofing material, and as a packing material. Most of the operations were on a relatively small scale and the annual production amounted to only a few thousand tons. The rapid increase in the production of peat moss since the commencement of the war is shown in the following table:

	<i>Tons</i>	<i>\$ Value</i>
1940.....	17,186	282,543
1941.....	27,803	644,253
1942.....	53,506	1,069,372
1943.....	64,360	1,461,422

In 1943, peat moss was produced at thirty plants in New Brunswick, Quebec, Ontario, Manitoba, Alberta and British Columbia, but the bulk of the output was from British Columbia (56 per cent); Ontario (17 per cent), and Quebec (23 per cent) and, as noted, most of it was exported to the United States. Forty-one per cent of the production was sold for poultry and stable litter, thirty-eight per cent for horticultural use, and twenty per cent for use in the manufacture of magnesium. The remainder was chiefly used as insulation material. The capital employed in this industry was reported as being just under two and a half million dollars, and the amount distributed as wages and salaries was just over one million dollars.

Future Possibilities: During the present war, Canada has been virtually the only available outside source of supply of peat moss for the United States. In the post-war years, competition from European countries can be expected, though no worthwhile forecast can be made of the possible extent of this competition. For the most part, producers in Europe had acquired an extensive knowledge of the varied requirements of consumers in the United States and, by

meeting these requirements in a satisfactory manner in regard to quality of product and regularity of shipments, they had attained the goodwill of these consumers.

In the meantime, however, Canada has become a dependable source of supply of good quality moss for the United States market, and, moreover, most of its active and potentially important deposits are within easy access to the principal United States outlets. Also there is a large potential market for peat moss in Canada, which, if developed to the full, would enable the Canadian industry to become firmly established as a continuing enterprise, even though the post-war demand in the United States were to decline considerably as compared with the present demand. To assist in the development of the Canadian market, the Mines and Geology Branch has issued several thousand copies of a booklet,* "Peat Moss or Sphagnum Moss; Its Uses in Agriculture, Industry and the Home" which

has been widely distributed throughout the country.

Producers of peat moss can do much in the way of educational publicity to further the use of their products in Canada, and they would probably find that in due course comparatively little publicity would be needed as the value of the products for their various uses would become widely recognized.

In reference to the development of a Canadian market it may be of interest to note that if the demand for peat moss in Canada were proportionate to that in Sweden, on the basis of population, seventy plants with a yearly capacity of 100,000 bales each would be required to supply the needs. This would provide direct employment for about 15,000 people and indirect employment for many others.

This is a feature worthy of emphasis, particularly in view of the attention that is being given to employment opportunities in the post-war years.

The booklet, "Peat Moss or Sphagnum Moss", by H. A. Leverin is now available for distribution and may be obtained, free of charge, from the Mines and Geology Branch, Department of Mines and Resources, Ottawa.

Right: Stack of dry peat moss—Pokemouche

**Bottom right: Baling and shredding mill—Isle aux Coudres*

Below: Peat litter factory and conveyor from storage shed with peat drying on racks in foreground — Pokemouche.





The barren peaks and ridges of the Mackenzie Mountains, at the headwaters of Root River

Photo by Eric Fry



A scenic view up the Twitza River Valley, the Mackenzie Mountains

Land Use Possibilities In Mackenzie District, N.W.T.*

by J. LEWIS ROBINSON

WARTIME activity and apparently rich mineral strikes in recent years have focused the attention of Canadians upon their northwestern domain. They want to know the extent and potentialities of the resources in the regions beyond the 60th parallel of latitude, particularly in the promising Mackenzie Valley.

Fur resources were primarily responsible for the exploration and settlement of Mackenzie District. Although still important, the exploitation of fur-bearing animals appears to have passed its peak, but may be revived by an increased interest in fur farming. Any future increase in population will probably be a result of the expanding mining industry, the present backbone of development. As a basis for a permanent population, however, soil resources have an important role in future development. What the region will produce and what use may best be made of the land are fundamental problems for interested Canadians.

An accurate picture of the land use possibilities can be obtained through a study of the controlling geographic factors of soil, topography and climate. These possibilities

may be limited to certain phases in Mackenzie District. The best soils, if they are near adequate markets and transportation, will be utilized for general farming. Since these markets are generally lacking at present, local gardening has become the chief utilization of the soil resources of the District. The development and expansion of horticulture can do much to improve the welfare of the white and Indian inhabitants for undoubtedly many of them suffer from diet deficiencies. There are also areas of good soils which support excellent forest growth. Since timber resources are also necessary for any future expansion of population, many of these forested areas should be so maintained rather than cleared for agriculture. There are other sections which are not favourable to growth of merchantable timber nor suitable for agriculture. These stunted forests will always be of some economic value as protection for the game and fur animals upon which the native and white trappers depend for a living. Finally, there are vast barren areas suitable only for reindeer and caribou pasturage. Future planning must balance all of these

*Prepared at the Bureau of Northwest Territories and Yukon Affairs, Department of Mines and Resources, for the Inter-departmental Committee on Agriculture in Northwestern Canada.



River Valley the Canol Road in the Mackenzie
Photo by C. A. Duncan



"Canada's Burma Road"—supply trucks crawl along the Canol Road through the Mackenzie Mountains above tree-line.
Photo by C. A. Duncan

factors and determine the best use of the land by considering the geographic and economic facts which control land utilization.

Topography and Soils

The only extensive areas of level land are found in the valleys of the broad Mackenzie River and its tributaries. From Fort Smith, on the southern border of the District, the Mackenzie River system extends northward for about 1,360 miles to Aklavik, flowing through a generally broad, flat valley varying in width from a few miles to about 40 miles. Although the Mackenzie Valley is the narrow northern continuation of the Great Central Plains physiographic region, which constitutes much of the Prairie Provinces, a great deal of the lowland is not arable because of large areas of lakes, muskegs, and poorly drained soils.

The eastern part of Mackenzie District is underlain by the scoured hills and ridges of the ancient Canadian Shield. Scattered glacial deposits which have not yet become soil, poor drainage, and, in the far northeastern part, severity of climate, have all combined to discourage vegetative growth on the Precambrian rocks of the Shield. To the west of the Mackenzie lowland, the jagged, bare-topped, picturesque peaks of the Mackenzie Mountains rise abruptly above the valley. This rather inaccessible range forms part of the boundary and is also a barrier between Mackenzie District and Yukon Territory. Except for the Liard River Valley at its southern end and the Peel River

in the north, the Mackenzie Ranges are traversed only by the recently constructed Canol Road and oil pipeline from Norman Wells to near Whitehorse, Yukon Territory.

Between the two flanking rugged areas, which are very different in topographic appearance, lies a lowland of sedimentary rock of Palaeozoic age, covered by deposition washed into the valley during the Glacial age. On top of the hundreds of feet of boulders, gravel and sand, post-glacial rivers have deposited a finer mantle. The broad Mackenzie River has incised a channel through the unconsolidated material, and flows between generally high banks of gravel and clay. Tributaries such as the Athabaska, Peace, Slave, Hay and Liard Rivers carry large amounts of silt in their waters and have built up flood plains along their courses and formed deltas at their mouths.

In many areas throughout the Mackenzie Valley there are sections of alluvial soil which have favourable physical properties for agriculture and forests. The Slave River, from the rapids at Fort Smith on the 60th parallel of latitude to Fort Resolution near its delta on Great Slave Lake, follows a meandering course through an alluvial lowland. The western boundary of the Canadian Shield parallels the Slave River a few miles to the east, but westward the semi-open wooded plain rises gradually towards the Caribou Hills in Wood Buffalo Park. Local areas such as that in the vicinity of the St. Bruno Mission, 20 miles west of Fort Smith

on the Salt River, have good agricultural possibilities, but only a small proportion of the remainder of the plain is suitable owing to swamps and sandy or gravelly ridges. At Fort Smith settlement the soil is quite sandy but along the lower course of the Slave River there are areas of deep clay with sandy ridges.

Some of the chief stands of merchantable timber in Mackenzie District are found along the Slave River. There are also many young stands of high potential value, which make the strip an important one for future development. Most of the timber used at Yellowknife and Fort Resolution has been cut in this area and floated downstream. Future land use practices will undoubtedly maintain many of these good agricultural soil areas for reserve timber.

West of the Slave River delta the south shore of Great Slave Lake is low and rises gently to a limestone escarpment which marks the northern edge of the Cameron Hills. The lowland is wooded and fairly level, with occasional swamps and several areas of grassland. The best alluvial soils are found at the mouths of rivers, the most extensive of which are at Hay River settlement. Good agricultural land has been reported farther south along the Hay River Valley but this area needs further investigation.

The eastern sections of Great Slave Lake are in the Precambrian rocks of the rugged Canadian Shield. In general the area is one of innumerable lakes separated by stretches of scrub timber or exposed bedrock. Although there are local areas of clay and sand marking former lake and stream deposits, most unconsolidated materials (muskeg, glacial drift, and immature soils) are limited to local depressions in the bedrock surface. Such glacial soil deposits are variable as to depth, texture, and reaction. Some fair stands of timber, useful for mining purposes, are present in the more sheltered depressions, but the remaining forest cover is generally stunted.

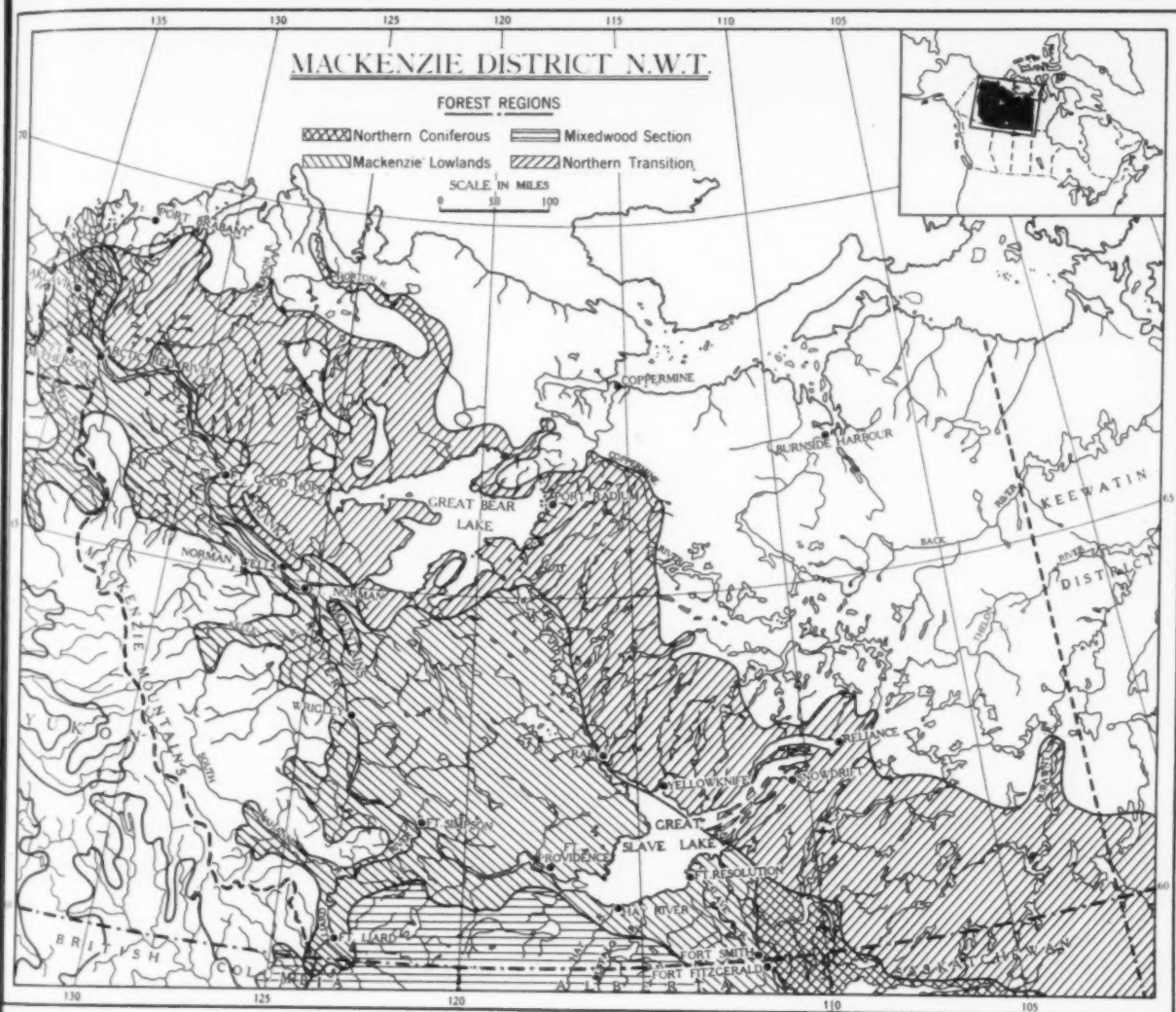
West of the north arm of Great Slave Lake and north of the Mackenzie River the lowland is interrupted by the flat-topped

plateau of the Horn Mountains which rises to altitudes of about 2,000 feet. Northward the muskeg and lake-dotted plain extends to Great Bear Lake and is separated from the main Mackenzie lowland on the west by the Franklin Mountains. Near the river much of the land is low, swampy, and wooded with small spruce, tamarack, and swamp birch. The chief settlements in the region are at Fort Providence and Fort Simpson, where limited general farming and successful gardening have been carried on for several decades.

Before the recent increase in population at Norman Wells, Fort Simpson was the largest settlement along the Mackenzie River proper. The village is located on a large alluvial island near the left bank of the Mackenzie River below its junction with the Liard. It contains the largest cultivated acreage of farm land in the Northwest Territories. Other areas of desirable alluvial soil are scattered in the vicinity on small islands and lower river terraces but no single large agricultural area is known.

The Liard River Valley, southwest of Fort Simpson, has good agricultural possibilities. Between Nelson Forks, B.C., and Birch River, river terraces are of almost continuous occurrence, and river bottom lands with good fertile soils occur in extensive blocks. Large alluvial islands are also numerous. Soils are generally a loam overlying a sandy base, and their fertility is reflected in the good growth of vegetation. Within the valley, between Nelson Forks and the Big Bend of the Liard, there are probably about 45,000 acres of river terraces suitable for agriculture, the best of which are south of Fort Liard post. The upland plains, about 300 to 500 feet above the river, may also have agricultural possibilities, but soils which have been developed there, on lacustrine or alluvial deposits, are not quite as favourable as those of the lower terraces.

The Liard Valley, however, is heavily wooded with large blocks of merchantable timber, chiefly spruce, and aspen and black poplar, as well as willow and alder. Since the timber could be floated downstream to



Forest regions of Mackenzie District

Fort Simpson, and from there to the lower river posts, it may play an important part in the future development of the District. Costs of clearing will be high for farming in this area, thus probably classing it as a reserve source of lumber rather than an agricultural centre.

The Mackenzie lowland from Fort Simpson to Fort Norman is an undulating plain lightly clad with spruce in the low areas and jackpine on the sand and gravel ridges. Along the river heavy stands of aspen poplar and birch are often indicative of good soils. Patches of merchantable spruce are scattered along the banks in sufficient quantity for local use but do not occur with sufficient frequency to constitute any considerable reserve.

Along the lower Mackenzie the silt load carried by streams draining from the mountains on both sides has built up local alluvial terraces and islands which are capable of being utilized for any future expansion of gardening activities. Cultivation of the islands, however, is rendered hazardous by occasional flooding following ice-jams.

North of Norman Wells a flat, poorly-drained plain, broken only by a few outcropping limestone escarpments, extends several miles westward from the Mackenzie River before reaching the low foothills of the mountains. Large areas are composed almost entirely of swamp, with a few small shallow ponds; lakes large and deep enough for landings by pontoon-equipped planes are few and far between. Most of the principal rivers of

this area, the Carcajou, Mountain, Arctic Red, and Peel, have cut deep gorges into the surface of the plain.

At Fort Good Hope the river banks rise to 150 feet and are sheer, precipitous walls of limestone rising from 125 to 200 feet at the Ramparts, slightly south of there. The Franklin Mountains decrease in altitude east of Fort Good Hope and the Mackenzie lowland broadens out to the northeast, extending uninterrupted to the Arctic Coast. The Mackenzie River terminates in a low, alluvial delta which is about 100 miles long and 50 miles wide and has numerous streams, channels, and cut-off lakes. Tree growth is found as far north as Aklavik on the delta, but trees other than spruce seldom exceed 20 feet in height. Arable areas are few and occur chiefly on the river banks where drainage is good. Garden produce for local consumption has been raised at the settlements of Fort Good Hope, Arctic Red River, Thunder River, Fort McPherson and Aklavik. Vegetables and green cereal crops raised at the latter place mark the northern limit of horticulture, but land use at Aklavik is limited by the permanent frost layer about 6 to 12 inches below the surface of wooded soils.

Physiographically, Mackenzie District has the long lowland of the Mackenzie River Valley, with an approximate total area of 125,000 square miles, as the only section of potential agricultural land. Within this area, however, there are many sections of unde-

veloped or poorly-drained soils. Because northern soils are generally low in organic matter, fertilizers are necessary for continual cropping. These factors, combined with severity of temperatures, uncertain rainfall, and permanently frozen sub-soil, restrict land use possibilities even within the lowland.

In soils which are permanently frozen, drainage is not possible and water collects in low places forming lakes of all sizes and shapes. Water then spills from one lake to another with a very indefinite drainage pattern. The permanently frozen zone, which is similar to large areas known in the Soviet Union, is of uncertain total depth, but has been recorded as 100 feet thick at Norman Wells, 175 feet at Yellowknife, and 345 feet at Port Radium. The depth of summer thawing varies according to the type of cover and local soil characteristics. In general, residents of the Mackenzie Valley estimate that thawing extends to about 3 to 10 feet under cultivated soil, only 2 to 3 feet in wooded soil, and is somewhat less under muskeg. Unless thawing extends to about 3 to 5 feet it is believed that there is a repressing effect upon root development. Crops and forests, however, do grow on soils of shallower thawing. Summer melting of frozen soil has one advantage in that it allows a gradual release of moisture which provides some sub-irrigation for growing crops and partially compensates for the inadequate rainfall.

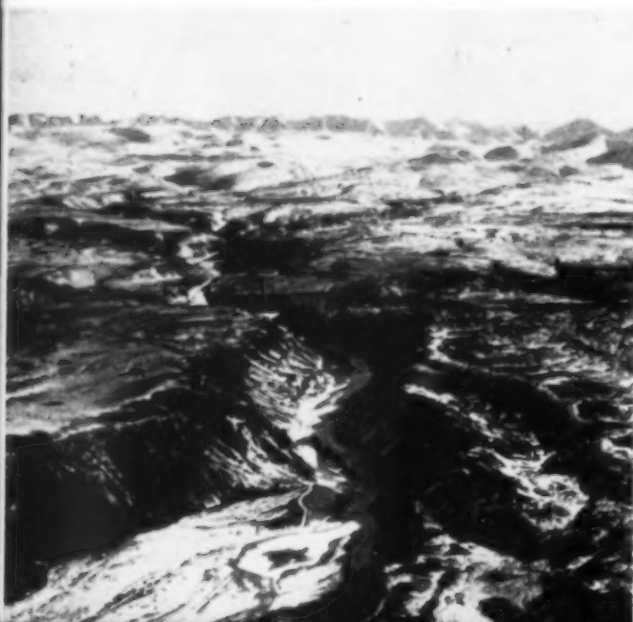
New land could be made available in Mackenzie District by clearing forests and stripping the moss cover, but many of these areas would be away from the river. Experience has shown that the frost danger is less along the river banks where air drainage is more active and where the warmer waters of the northward-flowing river have a modifying effect. More intensive utilization of these areas seems probable before there is much expansion into the interior.

Climate

In addition to topography and soils the climate of Mackenzie District is a further factor determining what may be grown in

The front ranges of the Mackenzie Mountains in the winter

Photo by R. Montgomery



the region. Although part of the area is north of the Arctic Circle, that line which was drawn upon the globe by the ancient geographers and mathematicians is not a true climatic line. The Arctic Circle is simply the southern limit of a zone which has one day or more of 24 hours of daylight in a single year; it does not separate the Arctic from the sub-Arctic. An Arctic region is a climatic term and defines an area within which average mean monthly temperatures never rise above 50° F. This climatic line closely coincides with the northern limit of tree growth, so that most Arctic areas are treeless, except for occasional small willows and low shrubs.

Although the Mackenzie Valley has the same latitude as Eastern Arctic areas around northern Hudson Bay and southern Baffin Island, warm air masses from the North Pacific pass over the former region in the summer causing average mean monthly temperatures to rise above 50° F. for the months of June, July, and August. Thus, the Mackenzie Valley, as far north as Aklavik, which is 110 miles north of the Arctic Circle at latitude 68 degrees, is wooded country and sub-Arctic. Since agricultural possibilities are dependent upon climate and not on latitude alone, many of the feats of growing gardens and crops in far northern latitudes are not exceptionally amazing.

Great ranges in annual temperatures are found in the Mackenzie River Valley. Temperatures have varied from an extreme minimum of -79 degrees at Fort Good Hope to an absolute maximum of 103 degrees at Fort Smith. The accompanying climatic charts show that winter temperatures are low. January is usually coldest, with average mean monthly temperatures of -15° to -23° recorded at each settlement. Average daily temperatures rise above the freezing point in late April or early May and the three summer months of June, July and August all have average mean temperatures ranging from 50° F. to 60° F. Despite a range in latitude of about 560 miles between Fort Smith and Aklavik, there is a certain uniformity of

Top:—From the Canol Road looking across the "Plains of Abraham" towards the Mackenzie peaks.

Centre:—Forest growth in the sheltered valley of Little Keele River, mile 60, Canol Road

Bottom:—Looking westward over the Mackenzie Lowland along the course of the Keele River, west of Fort Norman.

Photo by C. A. Duncan





Looking eastward across the Mackenzie Lowland. Steep banks of Carcajou River in foreground
Photo by Eric Fry

average summer temperatures which extends throughout the whole valley. Extreme maximum temperatures of 90° or more have been recorded at all stations except Aklavik, but average summer monthly maximums of 80 to 85 degrees are more usual. These figures illustrate that the Mackenzie Valley can be hot in the summer despite its northerly latitude.

The average frost-free period varies greatly owing to local differences in topography and air drainage. The extreme range is a minimum of 44 days at Fort Norman and a maximum of 92 days at Fort Resolution. Latest spring frosts usually occur around mid-June at most stations. This early average is similar to that of June 12 recorded in the known agricultural area at Fort Vermilion, northern Alberta. Spring planting in Mackenzie District usually precedes the average last spring frost; it is done in the third week of May in the Great Slave Lake area and carried out during the last part of May at the lower Mackenzie River posts.

There is greater irregularity in the occurrence of first fall frosts, which vary from early August to early September and are instrumental in killing the grain crops in cer-

tain seasons. At most stations there is a range of 50 to 60 days from the time the earliest fall frost has been recorded to the time of the latest fall frost. This precarious situation is the key to the future of agriculture in the Mackenzie Valley, and has been one of the factors placing the present northern limit of successful grain growth at Fort Simpson. The graphs at the bottom of the accompanying climatic charts illustrate the average frost-free period at each station, and also the maximum and minimum frost-free range.

Growth in the Mackenzie Valley is greatly influenced by the long duration of sunlight during the summer months. There is not continuous daylight at all the centres, as is often believed, but there are long hours of light, with correspondingly warm temperatures, which greatly assist rapidly-growing crops. The duration of sunlight (sun above the horizon) at certain of the posts during the summer is illustrated as follows:

Place	Latitude	HOURS OF SUNLIGHT			
		June 15	July 15	Aug. 15	Sept. 15
Ft. Smith	60°	19	18	15 ³ / ₄	13
Ft. Simpson	61° 52'	19 ¹ / ₂	18 ¹ / ₂	16	13
Ft. Norman	64° 55'	22 ¹ / ₂	20	16 ³ / ₄	13
Ft. Good Hope	66° 15'	24	21 ¹ / ₂	17	13 ¹ / ₄
Aklavik	68° 13'	24	24	17 ³ / ₄	13 ¹ / ₂

A low average annual precipitation of 10 to 13 inches is also a factor controlling agricultural possibilities. Although popularly pictured as a region of deep snows, the Mackenzie Valley actually receives less than one-quarter of the snowfall recorded at Ottawa, but slow evaporation allows it to remain on the ground throughout the winter. Forty to fifty per cent of the total precipitation falls as rain during the four summer months. As the accompanying charts illustrate, this summer precipitation, averaging 1 to 2 inches per month, is a precarious total and drought years have been one of the serious problems for both gardens and field crops. In dry years gardens have been irrigated or watered from the plentiful supply in the river, but the high banks which generally prevail have meant that irrigation increases costs for labour or pumping.

Early fall freeze-up of the Mackenzie River, which commonly occurs in middle or late October, is one of the problems facing local sections which now produce a surplus of agricultural and garden products for other areas. Since the river-boats are usually wintered at Fort Smith, and the Mackenzie route is long, the last boat going north passes Fort Simpson in late August and about the third week in September coming south. Thus, excess produce, chiefly potatoes at present, must be ready for shipment at these times. The settlements on the south shore of Great Slave Lake and along the Slave River have better transportation connections to Yellowknife, the chief local market. Their more favourable geographic location is an advantage for future agricultural expansion.

Historical Background

Exploitation of the fur resources of the Mackenzie River basin brought the first explorers and settlers into the region. Led by Alexander Mackenzie, the North West Company placed trading posts at strategic points along the Mackenzie system during the late eighteenth century. After merger with the Hudson's Bay Company in 1821 greater stability came to the fur-trading business and additional posts were founded. Because

food was expensive to import into the area, the pioneer post factors augmented a diet of fish and game by establishing gardens for local consumption. After the middle of the nineteenth century missionaries of the Roman Catholic and Anglican Churches also settled in the Mackenzie Valley and soon extended gardening areas. A flourishing farming and gardening industry had developed by the late nineteenth century to help feed the local residents. In 1911 the missions received assistance from the Dominion Experimental Farms Service and thereafter carried on co-operative trials at Fort Smith, Fort Resolution, Fort Providence and Fort Good Hope. During the early years of this century it is estimated that there was a greater total acreage under cultivation in the Mackenzie Valley than there is at present.

Since the last Great War the increase in white population, following mining pursuits, has been paralleled by improvements in type and increases in volume of transportation. Whereas the early settlers developed gardening as a means of supplementing their food supply, the present population is able to have most of its food shipped in. The white inhabitants are engaged in various activities—administration, fur-trade, mining, and missionary work—and agriculture has been a secondary interest.

At each of the settlements in the Mackenzie Valley there are local land use problems and peculiarities. The original centres were chosen not because of their agricultural possibilities, but for the exploitation of the fur and mineral resources of the District. This is still the primary function of the settlements. Field crops and garden produce,

Mackenzie Plain east of the Mackenzie River near Fort Good Hope

Photo by Eric Fry



however, are, and have been, growing throughout the Valley. In examining present land utilization and its geographic controls one has a starting point for discussions of future potentialities.

Present Agriculture

There are no farms in the Northwest Territories listed by the 1941 Census of Canada, and this information is correct in the sense that there is no farming industry comparable to that known in the settled areas of the provinces. A number of gardens, however, occupying several acres, are locally known as farms in Mackenzie District. Homesteads are not granted in the Northwest Territories, but agricultural leases may be obtained from the Government, and some are now in operation. The following table, derived from answers to a 1943 questionnaire of the Dominion Experimental Farms Service, illustrates the number and distribution of these gardens and farms in the Mackenzie Valley:

Local Centre	First Settled	White Population (1941)	No.	Gardens* Total Acres	No.	Farms Total Acres
Fort Smith	1874	241	30	50 (6)	3	50 (135)
Fort Resolution	1786	136	10	7	1	4
Snowdrift	1927	6	0	0	0	0
Yellowknife	1935	1,172	4	5 (10)	0	0 (15)
Fort Rae	1852	81	4	2	0	0
Buffalo River	1790	3	1	1½	0	0
Hay River	1868	16	10	8	—	—
Fort Providence	1823	39	4	6	1	5
Trout River	—	3	1	5	0	0
Fort Liard	1800	14	6	2	0	0
Fort Simpson	1804	76	30	15 (15)	4	70 (90)
Fort Wrigley	1877	6	5	1	0	0
Fort Norman	1810	63	10	4 (6)	0	0 (12)
Norman Wells	1921	643**	2	1	0	0
Fort Good Hope	1804	14	5	4 (6)	0	0
Thunder River	—	2	2	2	0	0
Arctic Red River	1891	11	2	2 (2)	0	0
Fort McPherson	1840	17	10	1	0	0
Aklavik	1912	167	12	4 (15)	1	4 (25)
		2,709	148	119½	10	133

*Estimates in brackets by F. V. Hutton, 1944.

**Revised 1944 total includes Fort Norman population.

There were, in 1943, a total of 148 gardens and 10 farms in the Mackenzie Valley, with an estimated total of 252 acres of cultivated land. If allowances are made for isolated gardens which were not reported, it is probable that the present cultivated acreage of the region, with a population in 1941 of 2,113 whites and 4,322 Indians, does

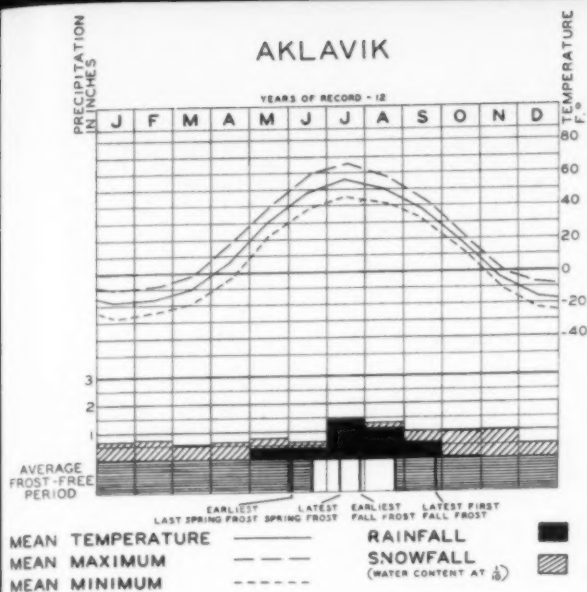
not exceed 300 acres. There are, however, several thousand additional acres of native grassland throughout the Mackenzie River system, scattered in large and small patches. Preliminary estimates of potential arable land indicate that there are from 2,500 to 3,500 acres near the present posts of the Mackenzie Valley. Since these areas are scattered, it is doubtful if there are any centres where a large agricultural community could develop.

Permanent agriculture has its basis in general farming, which produces a surplus of crops for sale. In Mackenzie District these field crops have been produced only on a small scale for a scanty local population. Although cereals have been matured in a few good years as far north as Thunder River, they are grown more successfully in the southern part of the District. Experimental work at Fort Providence illustrated that barley will ripen practically every year, oats in about three out of five years and

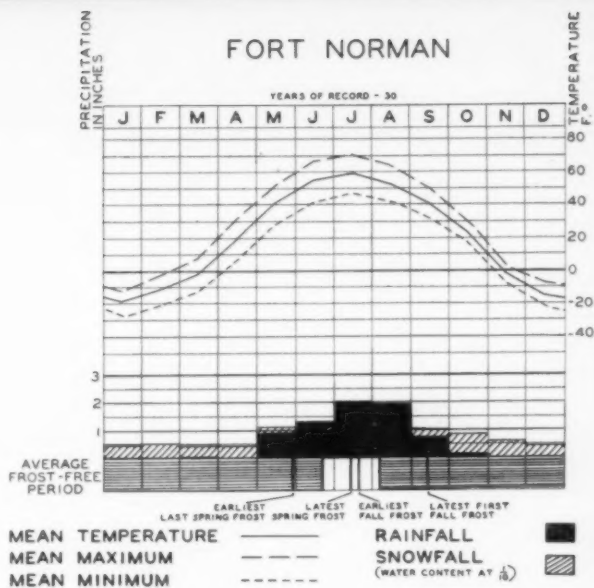
wheat only sometimes with difficulty. Usually these crops are utilized as cereal hay in years of early frost or inadequate rainfall. Forage crops have had variable success, with timothy, western rye, red top, and brome grass being most suitable.

North of Fort Simpson the uncertainties of climate make the growing of field crops

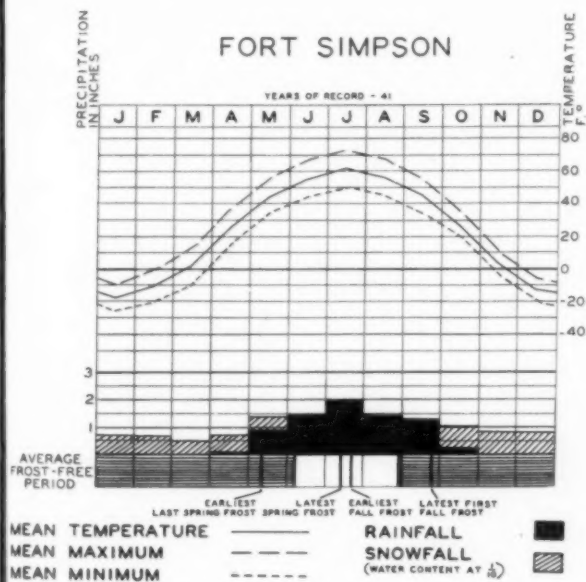
AKLAVIK



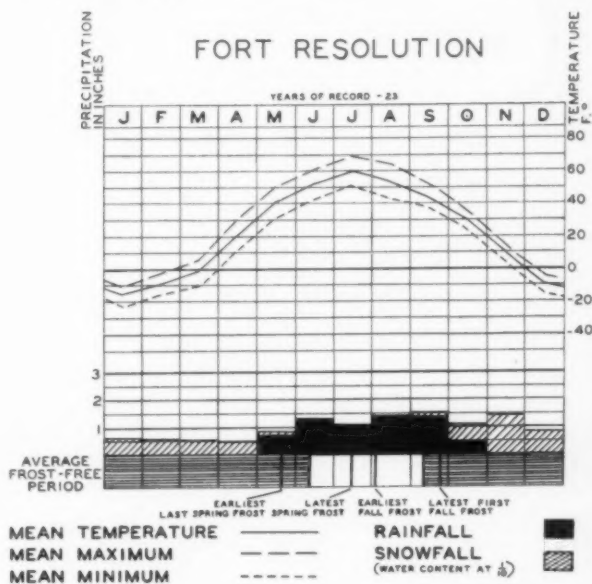
FORT NORMAN



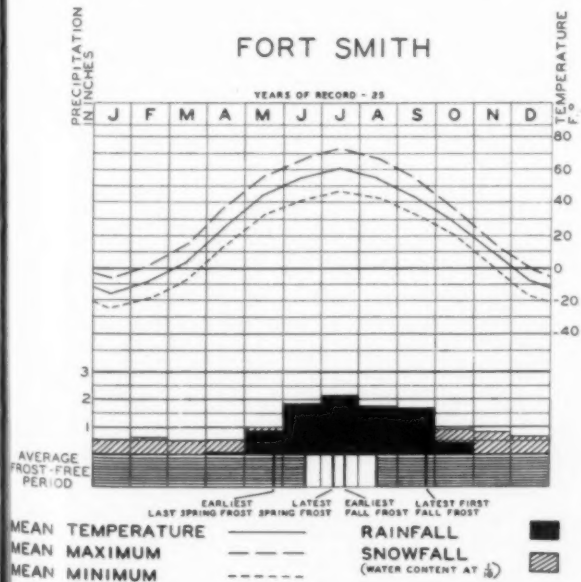
FORT SIMPSON



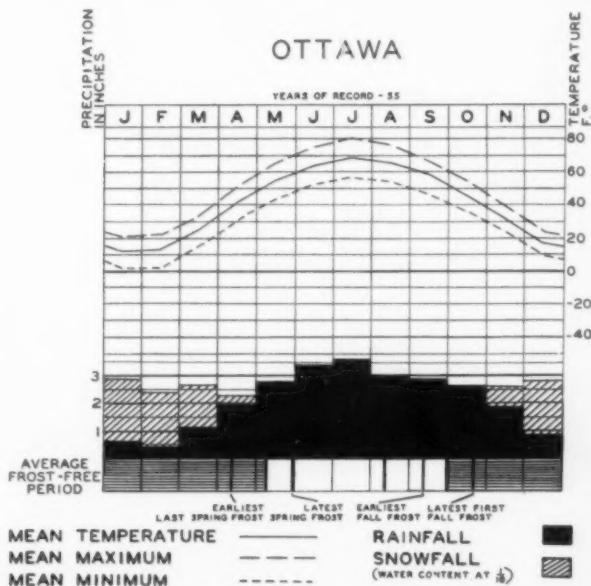
FORT RESOLUTION



FORT SMITH



OTTAWA





Above:—Winter in Mackenzie Valley—snowfall is not deep. Scene at the Negus gold mine near Yellowknife

Photo by Eric Fry



a rather hazardous or experimental occupation. The introduction of earlier maturing varieties and improved farming techniques could undoubtedly expand the acreage of the Mackenzie Valley farms, but at present it has been found more economical to ship in the processed products from more southerly agricultural areas.

Fort Simpson is an example of a centre where general farming and gardening have been carried on successfully since about the middle of the last century. In 1941 co-operative agricultural experiments were started there, and first results indicated that summer fallow is necessary to combat drought. The limitations of expanding general farming at the Mackenzie settlements are illustrated at Fort Simpson where much of the island is already cultivated. This acreage could probably be enlarged by another 100 acres, but local residents have not done it because of the high cost of labour for clearing and farm operations. The rolling plains on the mainland near Fort Simpson, about 100 to 200 feet above the river level, are reported to be topographically favourable, but the poor sandy soils are generally low in organic matter, and soil investigators do not consider them suitable agricultural lands. Expansion of gardening operations, however, is possible at several sites on the mainland, although the soils of the main island are probably most preferable.

Top to bottom:—

Fort Norman. Gardens in foreground Norman Wells, 1944. Franklin Mountains to the east behind

Arctic Red River settlement from the air Winter scene at Yellowknife town. Note the sledge tracks in the ice.

Photos by Eric Fry



A good range of varieties of garden vegetables is grown for table use and the local market. At all settlements the following vegetables are common: lettuce, spinach, radish, cauliflower, cabbage, kale, peas, carrots, beets, turnips, green beans, and potatoes. The latter produce as high as 200 bushels per acre in good years. Although tomatoes, squash, pumpkins and gourds are hazardous crops north of Fort Smith, they produce well under glass throughout the Valley. Perennial vegetables, with the exception of rhubarb of a poor quality, are not generally grown.

Cultivated strawberries and raspberries are grown at several of the settlements, while native fruits such as wild currants, gooseberries, blueberries, raspberries, and cranberries are found all along the river system. Crabapple trees successfully bore good crops of small fruit at Fort Resolution for several decades.

The variety and colour of the flowers raised at the Mackenzie River settlements has always been a delightful surprise to summer tourists. Most of the common annual flowers are cultivated and a number of perennials are also successfully grown. Wild flowers bloom in colourful profusion throughout the Valley. Free seed for a number of new varieties of flowers, better suited to the northern climate, is being introduced in 1945 by the Experimental Farms Service.

Although there are a few acres of gardens at all of the Mackenzie centres, Yellowknife is a good example of a mining town where there is a ready market for truck garden products. Yellowknife soils vary in type and fertility and some will need clearing of moss cover. By utilizing small pockets of natural or transported soil, however, a small garden industry has developed at Yellowknife to partially meet local demands. After a reconnaissance survey it was estimated that there are about 200 acres of potential agricultural land in the vicinity. Experimental work with

Top to bottom:—

Looking east over Hay River settlement and flat south shore of Great Slave Lake.

Fort Providence and the Mackenzie River. Note the larger amount of land which was once cleared and cultivated.

Fort Simpson settlement. Mackenzie River to the left and Liard River on the right

Fort McPherson on the banks of Peel River slightly south of the Mackenzie delta

Photos by Eric Fry



various types of vegetables and field crops is being carried out during the summer of 1945 on some test plots to assist the settlement in becoming more self-sufficient.

Live stock is scarce in the Mackenzie Valley owing to the high cost of imported feed. A total of 71 horses and cattle was reported in 1944. This scarcity of animals means that fertilizers have to be imported, thus increasing farming costs. Although fresh dairy products are popular, and, when available, command a good price, many prefer canned or powdered products at a lower price. Beef is cheaper to import than to raise locally, and the permanently frozen ground is used as a natural meat refrigerator. There are only a few goats, and no sheep, in the Mackenzie Valley because of the danger from the numerous hungry sledge dogs.

The stock maintained at Fort Smith and Fort Simpson are fed locally grown cultivated hay and green grains. At Aklavik the dairy farm experiment started by the Government Medical Officer developed to a herd of 13 cattle in 1944, but the number has since been reduced. The cattle are fed on native grass during the summer, while winter forage is green oats from the farm and grass cut from sedge meadows on the delta.

Poultry, for the production of fresh eggs, is kept at several points. While the cost of feed and winter heating is not economical, the expense is considered justifiable by the owners. Most flocks are started, and are maintained, by shipments of young chicks from Alberta.

The proximity of a good agricultural district in the Peace River area to the southward is one of the chief obstacles facing any expansion in the grain and livestock industry in the Mackenzie Valley. With recent improvements in the Grimshaw-Hay River winter road, and good summer water connections, the Peace region may profitably market many of its products to the northward in the future. Development of earlier maturing varieties pushed the Canadian agricultural frontier westward and northward and may be one of the chief methods of expanding land utilization in Mackenzie

District. It is probable, however, that the Valley will always be dependent upon outside areas for the bulk of its food.

Food Imports

Although the extent of agriculture carried on by the white residents of Mackenzie District may be surprising to persons unfamiliar with geographic conditions there, it still remains primarily a local industry. The accompanying table of statistics illustrating import estimates has been compiled by officers of the Experimental Farms Service from answers to questionnaires sent out in 1943. Totals do not include the large amounts shipped to men on the Canol Project at Norman Wells, since this was not normal consumption, but the final figures are undoubtedly affected to some degree by war-time activity in the Mackenzie Valley. The table emphasizes the dependence of the white population upon imported food, and shows that present land utilization could be greatly expanded to assist the local residents.

Total amounts of food imported into Mackenzie District during the year 1942-43 probably exceeded 750 tons, and this was supplemented by about 200 to 300 tons of locally produced game and cultivated food. Practically all of these imports entered the Northwest Territories by way of Edmonton, and over one-third of them were shipped to Yellowknife.

Potatoes are the only locally-raised product which is shipped in any amount. Enough potatoes are grown in the settlements along the central Mackenzie River to make these places self-sufficient in the product, with a slight exportable surplus. Imports of potatoes from "outside" are difficult to assess from the statistical table since undoubtedly many imports are actually grown within the District. For example, Aklavik is supplied by the Mackenzie River centres farther south, and Yellowknife received part of its potato supply from Fort Smith and the Great Slave Lake settlements. Similarly, many of the potatoes imported by Fort Smith are actually transshipped to Yellowknife. On the whole, Mackenzie District



Left, top to bottom:—

Cereal plots at the co-operative Experimental Sub-Station at Fort Simpson Photo by F. V. Hutton

Roman Catholic Mission potatoes at Fort Norman Photo by F. V. Hutton

One of the gardens at the Arctic Red River settlement Photo by Eric Fry

Potatoes at Fort Good Hope showing the effect of sprouting before planting. Those on the left were unsprouted. Photo by F. V. Hutton

Right, top to bottom:—

Garden carved out of the rock at Yellowknife. Note greenhouse near dwelling. Photo by M. Meikle

Crab apple trees at Roman Catholic Mission at Fort Smith. The trees had small apples on August 9th, 1944. Photo by F. V. Hutton

One of the many typical hay meadows of the Mackenzie Valley. Scene near Yellowknife. Note the bare rock ridges and scrub forest in the background. Photo by F. V. Hutton

Dr. Livingstone's cattle and dairy farm at Aklavik, 1944 Photo by F. V. Hutton

Sawmill and lumber for construction of Mackenzie River barges

Photo by H. L. Holman



probably produces about 160 tons of potatoes and imports an additional 40 to 50 tons from other parts of Canada.

Flour is one of the largest single food imports of Mackenzie District. Annual totals exceed 340 tons. No serious attempt has been made to grow wheat within the region except for local feed. At one time a flour mill at Fort Vermilion, on the Peace River, supplied much of Mackenzie District, but this was not able to remain in operation when better transportation permitted flour to be shipped in more economically from centres farther south.

The extent to which horticulture has developed is reflected in the table showing that only about 10 tons of fresh vegetables are imported. Aklavik is the only centre with a large import, owing to the retarding effect of the permanent frost zone upon root vegetables. Locally-produced vegetables are meant chiefly for summer consumption in the Mackenzie Valley, and the rest of the year's supply comes from the 80 tons of canned vegetables imported—most of which are consumed at Yellowknife.

The large settlements are the only places where there is a noticeable trade in fresh (frozen) domestic meat. Some of the settlements raise a few cattle which ultimately become beef, but on the whole they depend upon wild game for fresh meat. There is an average annual consumption of 350 reindeer carcasses in the Aklavik area from the nearby Government herds. This amount does not appear in the accompanying table of meat

imports, but as a source of food the reindeer herds may be an important factor influencing future settlement in this area. Game supplies have to be supplemented by canned and preserved meats which are imported into all of the settlements to a total of about 54 tons.

Fresh eggs are obtained at only a few centres and in limited quantities. About 3,000 dozen eggs are locally produced—half of these at Fort Smith, and about 50,000 dozen are imported.

The dairying industry has received very little incentive. Despite the psychological value of having fresh milk, present residents have not found dairying practical owing to the cost of imported feed, and the necessary long winter feeding. Over 2,000 cases of canned milk are imported annually by the Mackenzie Valley residents. An additional importation of 56,000 pounds of butter illustrates the possibilities of a grazing industry which could raise its own feed and prove economical enough to compete with cheaply-imported products.

Forest Utilization

There is no lumbering industry in Mackenzie District similar to that in the provinces, but the area is fairly well forested and supplies lumber for local needs. As previously mentioned much of the region contains stunted timber of no present economic value as lumber, but merchantable stands are known along the Slave and Liard Rivers.

Proper land utilization must maintain

some of the good soil areas as forest reserves, and this resource must be protected from the ravages of fire. Forest fires can destroy large areas of hunting and trapping grounds thereby impairing the livelihood of the Indians. Forest conservation is thus concerned not only with saving forests for lumber, but also in having forests to protect game, fish and fur. For the latter, timber does not have to be merchantable, for even brush and scrub can be a protection. Forest fires in Mackenzie District have become more numerous and of larger proportion in recent years and have often hindered air transportation. This condition has resulted in the establishment of a forest fire protection system in the District in 1945.

No estimates of the amount of reserve timber are available, but it is known that present cutting rates are having little effect upon the total forest reproduction. The following table shows the annual totals of timber cut in Mackenzie District for the past 10 years. Most of it has been cut in the Slave River area.

Year	Board Feet	Linear Feet	Cords
1933-34	201,884	41,052	85
1934-35	341,644	23,923	5,589
1935-36	289,320	50,732	5,788
1936-37	364,253	66,940	5,683
1937-38	599,804	57,372	13,277
1938-39	946,743	38,108	12,167
1939-40	763,756	45,762	11,025
1940-41	1,012,826	82,079	9,760
1941-42	1,748,649	29,660	17,656
1942-43	1,760,863	27,230	18,594
1943-44	963,024	252,856	11,184

The amount of locally grown timber being cut has been gradually increasing. The mining activity at Yellowknife following 1937

gave a larger demand, and the increase continued when wartime activities reached the District. The preceding table does not include the timber cut for the Canol Project which totalled 813,000 board feet and 9,000 linear feet in 1942-43, and rose to 4,835,000 board feet, 52,675 linear feet, and 16,000 telephone poles in 1943-44. The forest resources of Mackenzie District played an important part in this building project, and will be available for any future utilization.

Government Assistance

In order to assess the present extent of land utilization in Mackenzie District, and have facts available for future planning, various Government departments have assisted by sending scientific specialists into the field during recent years. In the field of northern agriculture an Interdepartmental Committee was formed in February, 1943, with representatives from the Departments of Agriculture and Mines and Resources, under the Chairmanship of Dr. E. S. Archibald, Director of Experimental Farms Service.

One of the results of the formation of the Committee has been field investigations on agricultural possibilities. These were carried out by Dr. A. Leahey, and F. V. Hutton of the Dominion Experimental Farms Service. Leahey travelled along the Alaska Highway in northern British Columbia and the Yukon in 1943, and in southern Mackenzie District in 1944. Hutton visited the settlements along all the Mackenzie River during the summer of 1944. The Lands, Parks and Forests

*Logs cut for local use,
Slave River delta.*

Photo by H. L. Holman



Branch also sent H. L. Holman of the Dominion Forest Service into the Mackenzie Valley in 1944 to report on a suitable forest fire protection system for the southern part of the region. He will return to the area in 1945 to assist in the organization of this system.

Further soil investigations and gardening assistance will be undertaken during the summer of 1945 by personnel of the Experimental Farms Service. Particular attention will be given to the town of Yellowknife so that a post-war mining population may have a greater local food supply. Soil surveys will also be made in the potential agricultural area along Salt River. In addition, the agricultural experts will investigate possible sites for Experimental Sub-Stations which can assist and direct the future of agriculture in Mackenzie District.

As a result of Dr. Leahey's soil survey of the Liard Valley and Mackenzie Valley south of Fort Simpson, it is known that large tracts of unsettled land in the middle Liard Valley have agricultural possibilities. With regard to general agriculture in Mackenzie District, he believes that there are several areas where all the physical requirements for successful farming are present, but any ultimate development or expansion is closely linked with the matter of markets.

The most intensive use of the land at present is for gardening, and Hutton's horticultural survey investigated the possibility of increasing the production of fresh vegetables, meat, eggs, and milk so that a post-war influx of settlers would have lower costs of living and improved health and well-being. Through personal contact with the gardeners of the Mackenzie Valley, expert advice on type and quantities of fertilizers was furnished, and the use of earlier maturing varieties suggested. Local residents should now be able to produce more from their present plots and know the possibilities of extending them. Much of the gardening has been haphazard, but, in 1945, the Experimental Farms Service is sending seeds and fertilizer free of charge to a select list of 32 co-operators in the Mackenzie Valley, and, in ad-

dition, will again give personal assistance and advice. The future should witness an improvement in the gardening industry.

Conclusion

On the whole, the Mackenzie Valley has certain favourable geographic conditions which will support limited general farming, an expanded horticultural industry, and adequate forest reserves. The future of development will be closely linked with progress in the utilization of earlier maturing grains and vegetables. The current soil surveys and other field investigations are important in establishing basic facts concerning land use possibilities of the region. These correlated facts will play their part in the general plan of study and use of the natural resources of the Canadian Northwest.

Bibliography

1. Albright, W. D. "Gardens of the Mackenzie", *Geographical Review*, January, 1933
"Crop Growth in High Latitudes", *Geographical Review*, October, 1933
"Past, Present and Future of the Peace", *Canadian Geographical Journal*, March, 1938
"Cropping North of Sixty", *American Association for the Advancement of Science*, June, 1938
2. Archibald, E. S. "Agricultural Lands in the Canadian Northwest", *Canadian Geographical Journal*, July, 1944
3. Beaver, The. "Post Gardens", Winnipeg, June, 1942
4. Camsell, Charles. "Planning the New Northwest", *Canadian Geographical Journal*, December, 1943
"Opening the Northwest", *The Beaver*, Winnipeg, June, 1944
5. Camsell, C., and Wyatt, M. "The Mackenzie River Basin", Memoir 108, No. 92. Geol. Survey, Dept. of Mines, Ottawa, 1921
6. Canada, Department of Agriculture, Experimental Farms Service, "Experimental Sub-Stations, 1931-38", Ottawa, 1939, P. 49-56
Dept. of Mines & Resources, Lands, Parks & Forests Branch, "The Northwest Territories", Ottawa, 1944, P. 40
7. Ellis, F. H. "Where Farms Meet Frontiers", *The Beaver*, Winnipeg, Sept., 1941
8. Hume, G. S. "Mackenzie River Area, District of Mackenzie", Geol. Survey of Canada, Summary Report, 1923, Pt. B
9. Lloyd, Trevor, "Activity in Northwest Canada", *Journal of Geography*, May, 1943
10. Moore, P., Kruse, H. D., Tisdall, F. F. "Nutrition in the North", *The Beaver*, Winnipeg, March, 1943
11. Porsild, A. E. "Edible Roots and Berries of Northern Canada", Canada, Dept. of Mines & Resources, National Museum, Ottawa, 1937
12. Preble, E. A. "A Biological Investigation of the Athabaska-Mackenzie Region", *North American Fauna*, No. 27, U.S. Dept. of Agriculture, 1908
13. Raup, H. M. "Botanical Investigations in Wood Buffalo Park", Canada, Dept. of Mines, National Museum of Canada, Bulletin No. 74, Ottawa, 1935

LAND USE POSSIBILITIES IN MACKENZIE DISTRICT, N.W.T.

PRODUCTION AND IMPORTATION OF FOOD IN THE MACKENZIE RIVER BASIN, 1943*

Settlement	Potatoes Produced Locally	Potatoes Imported	Flour Imported	Fresh Vege- tables Imported	Canned Vege- tables Imported	Fresh Domestic Meat Imported	Canned Meat Imported	Eggs Produced Locally	Eggs Imported	Milk Imported	Butter Imported
	lb.	lb.	tons	lb.	cases	lb.	cases	doz.	doz.	cases	lb.
Aklavik	2,000	30,000	75	10,000	400	Nil	250	100	12,000	300	6,000
Fort McPherson	1,000	5,000	25	Nil	40	Nil	40	Nil	600	40	2,000
Arctic Red River	2,000	2,000	7	Nil	10	Nil	25	Nil	600	30	500
Fort Good Hope	12,000	2,000	16	Nil	35	Nil	250	Nil	3,300	85	1,600
Fort Norman	22,000	Nil	20	Nil	15	Nil	250	50	3,000	160	3,600
Fort Wrigley	750	Nil	5	100	5	Nil	15	Nil	210	12	400
Fort Simpson	100,000	Nil	35	2,000	85	1,200	250	800	4,500	145	3,800
Trout River	30,000	Nil	3	Nil	A few	Nil	12	Nil	150	7	400
Fort Providence	40,000	Nil	35	Nil	30	Nil	50	150	1,500	40	2,000
Hay River	12,000	Nil	10	500	50	2,000	100	Nil	1,500	80	2,000
Buffalo River	5,500	Nil	-	-	-	-	-	Nil	-	-	-
Fort Rae	1,200	2,000	15	1,000	63	1,000	165	Nil	1,500	50	2,000
Yellowknife	Nil	100,000	75	3,750	2,500	80,000	500	600	15,000	1,000	25,000
Snowdrift	Nil	1,000	5	400	25	Nil	20	Nil	360	15	1,500
Fort Resolution **	27,000	Nil	-	-	-	-	-	150	-	-	-
Fort Smith	50,000	25,000	8	1,000	42	12,000	250	1,200	4,500	100	3,000
Fort Liard	10,000	Nil	7	Nil	15	Nil	75	Nil	750	55	1,500
Totals***	315,450	187,000	341	18,750	3,315	96,200	2,252	3,050	49,470	2,119	55,450
Totals in Tons	157.7	83.5	341.0	9.4	79.6	48.1	54.0	2.3	37.1	50.8	27.7
Total Imports	731.2 tons										

*Compiled at the Experimental Farms Service, Department of Agriculture, Ottawa.

**Incomplete.

***All figures are usually estimates.

*This article is based chiefly upon unpublished information contained in the files of the Bureau of Northwest Territories and Yukon Affairs. Supplementary information may be obtained from the above titles.



Forest growth at one of the many lakes near Fort Smith

Photo by H. L. Holman

John Cabot of Bristol

by LAWRENCE J. BURPEE

NOWADAYS most of us think of Bristol as one of those gallant seaports of England that have endured so much with heads that are bloody but unbowed, or perhaps we remember that out of Bristol comes an exquisite sherry. But long before wars had become world-wide, or Bristol Cream famous, this ancient port was known throughout the Seven Seas as the home of daring and adventurous captains.

From Bristol, on a May morning in 1497, sailed the *Matheu*, a fair-sized ship in those days, but one that to-day might be lost in the hold of a transatlantic liner. Her captain, John Cabot, was on his way to discover a new route to the riches of China and the Indies, having been inspired to make the attempt by the report of what another Italian, Christopher Columbus, had found on his voyage of a few years before.

The world's great explorers may be divided, from one point of view, into two groups: those who have made discoveries and written about them, and those who have made discoveries and let their deeds speak for themselves. John Cabot was one of the latter. There is no record that he ever prepared an account of the 1497 voyage; and it would have saved many a headache to modern historians if the map upon which he marked his landfall had survived. As it is, all that we have is the map of his son Sabastian, published nearly half a century later, and it is not even certain that Sebastian was with him on the voyage. On the evidence of this and other more or less contemporary maps, and such facts as may be gleaned from other sources, three distinct theories have been built up as to where Cabot landed on the continent of North America, in 1497. One of these favoured a landing on the coast of Newfoundland, the second preferred Labrador, and the third

voted for Cape Breton. It would be out of the question in this brief sketch to attempt to describe or discuss the grounds on which these three theories are based. I managed at one time to arouse the indignation of an eminent Newfoundland historian by suggesting that the consensus of scholarly opinion favoured Cape Breton. Now I think it better to leave the matter open.

Fortunately we do know something about the voyage, thanks to the fact that the Duke of Milan at that time had in London an ambassador who enjoyed running about and picking up odds and ends of information, which he put into entertaining letters to the Duke. In one of them he describes his visit to the *Matheu* on her return from overseas.

"Perhaps amidst so many occupations of your Excellency," he writes, "it will not be unwelcome to learn how his majesty here has acquired a portion of Asia without a stroke of his sword. In this kingdom there is a lower class Venetian named Master Zoanne Caboto, of a fine mind, very expert in navigation, who, seeing that the most serene kings, first of Portugal, then of Spain, have occupied unknown islands, meditated the achievement of a similar acquisition for his majesty aforesaid, and having obtained royal grants securing to himself the profitable control of whatever he should discover, since the sovereignty was reserved to the crown, with a small ship and eighteen persons he committed himself to fortune and set out from Bristol, a western port of this kingdom, and having passed Ireland, which is still further to the west, and then shaped a northerly course, he began to navigate to the eastern parts, leaving, during several days, the north star to the right; and having wandered about considerably, at length he fell in with *terra firma*, where he set up the royal standard, and having taken possession for this king and collected several tokens, he came back again.

"The said Master Zoanne, being a foreigner and a poor man, would not be believed if the crew, who are nearly all English and from Bristol, did not testify that what he says is true. This Master Zoanne has a drawing of the world on a map and also on a solid globe which he has made, and shows the point he reached, and going towards the east he has passed considerably the country of the Tanais. And they say that the land is excellent

and the air temperate, and they think that Brazil wood and silks grow there; and they affirm that the sea is covered with fish which are caught not merely with nets but with baskets, a stone being attached to make the basket sink in the water, and this I heard the said Zoanne relate. And the said Englishmen, his companions, say that they will fetch so many fish that this kingdom will have no more need of Iceland, from which country there comes a very great store of fish which are called stock-fish.

"But Master Zoanne has set his mind on something greater; for he expects to go from that place already occupied, constantly hugging the shore, further towards the east until he is opposite an island called by him Cipango, situated in the equinoctial region, where he thinks grow all the spices of the world and also the precious stones; and he says that once upon a time he was at Mecca, whither the spices are brought by caravan from distant countries, and those who brought them, on being asked where the said spices grow, answered that they did not know, but that other caravans come with this merchandise to their homes from distant countries, who again say that they are brought to them from other remote regions. And he argues thus, that if the orientals affirm to the southerners that these things come from a distance, and so from hand to hand, presupposing the rotundity of the earth, it must be that the last people get them in the north towards the west. And he speaks of it in such a way that, not costing me more than it does, I too believe him.

"And what is more, his majesty here, who is wise and not lavish, likewise puts some faith in him; for since his return he makes him a very fair allowance, as this Master Zoanne himself tells me. And it is said that in the spring his majesty aforesaid will fit out some ships, and besides will give him all the malefactors, and they will proceed to that country to form a colony, by means of which they hope to establish greater depot for spices in London than there is at Alexandria. And the chief men in the enterprise belong to Bristol, great sailors, who now that they know where to go, say that it is not more than a fifteen days' voyage thither, nor do they ever have storms after they leave Ireland.

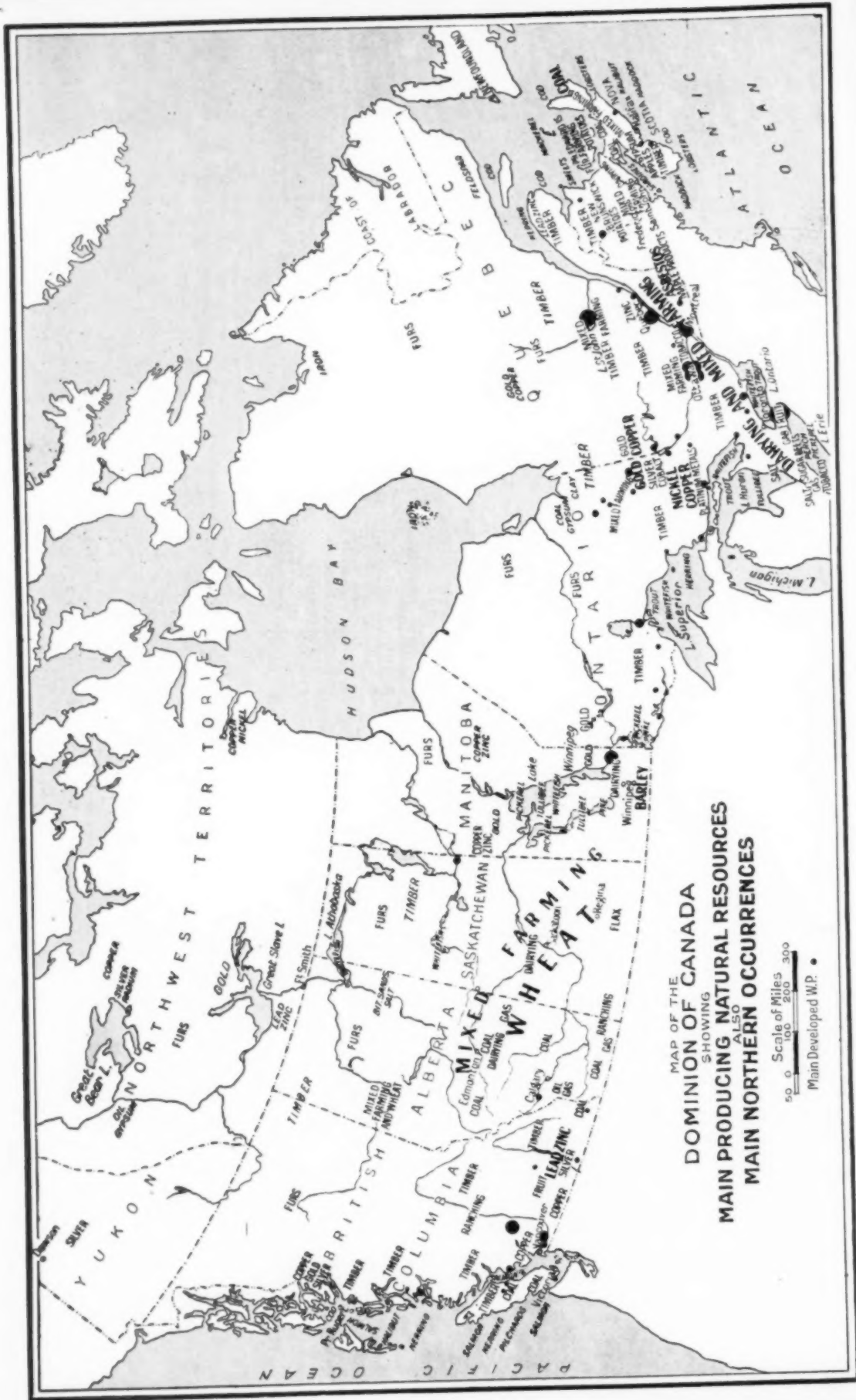
"I have also talked with a Burgundian, a companion of Master Zoanne's, who confirms everything and wishes to return there because the Admiral (for thus Master Zoanne now styles himself) has given him an island; and he has given another to a barber of his from Genoese Castiglione, and both of them consider themselves counts, nor does my Lord the Admiral esteem himself less than a prince. I think that on this voyage will also go some poor Italian monks who all have promises of bishoprics. And having become a friend of the Admiral's, if I wish to go I should have an archbishopric."

In addition to this breezy letter of Raimondo di Soncino, there has also been preserved one by Lorenzo Pasqualigo to his brothers in Venice.

"That Venetian of ours who went with a small ship from Bristol to find new islands," says Pasqualigo, "has come back and says he has discovered mainland seven hundred leagues away, which is the country of the Grand Khan, and that he coasted it for three hundred leagues and landed and did not see any person; but he has brought here to the king certain snares which were spread to take game and a needle for making nets, and he found certain notched trees so that by this he judges that there are inhabitants. Being in doubt he returned to his ship; and he has been three months on the voyage; and this is certain. And on the way back he saw two islands, but was unwilling to land, in order not to lose time, as he was in want of provisions.

"The king here is much pleased at this; and he says that the tides are slack and do not run as they do here. The king has promised him for the spring ten armed ships as he desires, and has given him all the prisoners to be sent away, that they may go with him, as he has requested; and has given him money that he may have a good time until then, and he is with his Venetian wife and his sons at Bristol. His name is Zuam Talbot and he is called the Great Admiral and vast honour is paid to him and he goes dressed in silk, and these English run after him like mad, and indeed he can enlist as many of them as he pleases, and a number of our rogues as well. The discoverer of these things planted on the land which he has found a large cross with a banner of England and one of St. Mark, as he is a Venetian, so that our flag has been hoisted very far indeed."

In 1498, with the encouragement of Henry VII, Cabot sailed again to America, taking with him his three sons. His previous expedition had raised the hopes of the king and his ministers that rich cargoes might be brought from the west, and Cabot had no difficulty in getting two well-found ships and full crews. He sailed much farther to the north until he came to the east coast of Greenland. Here his men mutinied because of the extreme cold, and he had to put about and sail south down along the coast of the continent. He apparently mistook both Hudson Strait and the Strait of Belle Isle for bays, and did not enter them. Following the coasts of Newfoundland, Nova Scotia and New England, he seems to have got down as far as Chesapeake Bay, when the low state of his provisions forced him to return to England. His reception there was what might be expected. He came back empty-handed, and from that time John Cabot dropped out of sight. No one knows when or where he died.



Canada's Contribution to the Food Supply of the United Nations

by A. E. RICHARDS*

Editor's Note:-

The following article was prepared by special request to inform our readers concerning the world food situation and Canada's position with respect to present needs. This factual statement provides a challenge to Canadians to tighten their belts in the interests of humanity—a vital contribution required at this time, if Canada is to play her full part in winning the Peace. Europe is hungry. It is not enough to supply from our abundance; we will need to go a step farther—eat more sparingly, conserve more stringently and share as we have not done to date.

IN THE WARTIME production of food Canadian farmers have established a remarkable record of performance and have exceeded the expectations of farm leaders and the technical workers in agriculture who should have a reasonable appreciation of Canada's capacity to produce. Nearly every wartime production objective has been surpassed, and nearly every contract entered into for the supply of food to our allies has been exceeded.

The size of the map of Canada is apt to be misleading in assessing Canada's capacity to produce food. Out of a total land area of 3½ million square miles one-half million square miles, or 16 per cent, is classified as having agricultural possibilities. This figure is a rough estimate and at best a considered guess. Of the land having agricultural possibilities, 250,000 square miles or about 8 per cent of the total land area is occupied in farms, and of the land in farms, only one-half has been brought under cultivation. This reduces the agricultural map of Canada to approximately 86 million acres of land under cultivation, which is one-quarter of our potential farm land or 4 per cent of the total land area.

If cultivation were extended considerably, it would be to less productive land, the

greater part of which, measured by present-day standards, would be considered sub-marginal. It is considered that much of the potential farm land can be put to best use by leaving it under its forest cover for wood supplies and to conserve our watersheds and power resources. Improved varieties of farm crops, drainage and irrigation projects, new types of machines, and the development of land and air transport may extend the boundaries—in time.

The number of farms in Canada, according to the 1941 census, is 732,715. The farm population in that year was 3,165,288 or 27.5 per cent of the total population. The persons gainfully occupied in agriculture numbered 1,081,944 or 9.4 per cent of the total population. This number represents 25 per cent of the gainfully employed in Canada. It is estimated that since the beginning of the war some 400,000 workers have left farms to enlist in the armed services and to find employment in cities and towns.

War record of farm production

Canada's capacity to produce food in wartime was not increased by extending the boundaries of production. The increase was brought about with the aid of some new equipment, but mainly with reliance on older machines and fewer hands working longer hours and more intensively. With 25 per cent less gainfully employed on farms, Canada's annual production of farm products has increased approximately 40 per cent since the beginning of the war—a significant achievement.

Price incentive and patriotism have been vital factors in achieving this increase, but favourable weather and freedom from disease have been equally important contributors.

With many sources of Britain's food supplies overrun by the enemy, and shipping lanes blocked in the early years of the war,

*Secretary, Agricultural Food Board

Canada was called upon to replace a good share of the loss. How Canadian farmers responded to the call for more and more food

to sustain the army of fighting men and workers overseas and at home is indicated in the following table.

WARTIME PRODUCTION OF FOOD IN CANADA

		1939	1944	Per cent change
Hog slaughterings	hd.	3,628,000	8,766,000	+ 141.6
Cattle slaughterings	"	873,000	1,354,000	+ 55.1
Sheep and lamb slaughterings	"	786,000	949,000	+ 20.7
Flour	bbl.	16,833,823	24,300,083	+ 44.4
Total milk	lb.	15,781,000,000	17,605,000,000	+ 11.6
Butter—farm	"	87,459,000	54,580,000	- 37.6
creamery	"	267,613,000	298,251,000	+ 11.4
Total	"	355,072,000	352,831,000	- 0.6
Cheese—farm	"	856,000	753,000	- 12.0
factory	"	125,475,000	178,229,000	+ 42.0
Total	"	126,331,000	178,982,000	+ 41.7
Concentrated milk	"	131,774,000	221,699,000	+ 68.2
Ice cream	gal.	8,509,000	17,666,000	+ 107.6
Fluid milk—sales	lb.	3,011,515,000	3,912,476,000	+ 29.9
consumed on farms	"	1,809,839,000	1,717,191,000	- 5.1
Total	"	4,821,354,000	5,629,667,000	+ 16.8
Eggs	doz.	221,737,000	374,772,000	+ 69.0

Canada's food commitments to the United Nations

Contracts for specific minimum requirements of various food products have been negotiated each year of the war with the

United Kingdom, but Britain has taken all the food that Canada could send her. From these shipments Britain has allocated certain quantities to other allied countries where and when need is shown.

CANADIAN WARTIME EXPORTS OF FOOD

		1939	1944	Per cent change
Bacon	lb.	187,825,000	695,757,400	+ 270.4
Canned meat	"	4,642,280	39,707,389	+ 755.3
Beef, fresh-frozen	"	3,873,200	103,203,800	
Flour	bbl.	5,342,172	13,938,631	+ 160.9
Wheat	bus.	109,050,542	291,479,709	+ 167.3
Cheese	lb.	90,945,000	131,429,000	+ 44.5
Concentrated milk	"	32,169,000	46,520,000	+ 44.6
Eggs	doz.	1,274,000	81,700,000	

Throughout the war years the British food ration has been comparatively low in animal protein, and the people of continental Europe have experienced an acute deficiency. To help overcome the shortages, Canada was called on to supply all the meat, cheese, evaporated milk, and eggs that she

could provide. Contracts have been negotiated for minimum quantities of these products at firm prices through 1945 and 1946. The stated quantities are basic only. All the meat, cheese, milk and eggs that Canada can ship overseas are needed and will be taken at least up to the end of 1946.

The exporting Boards aim at least to maintain the record of 1944 with certain adjustments and some increases. In July, 1944, Canada contracted to supply the United Kingdom with a minimum quantity of 100 million pounds of beef during the two-year period, 1944 and 1945, and, in addition to this minimum quantity, all further surpluses of beef that would become available. The negotiation of this contract had the effect of assuring floor prices for beef. Actual shipments during the year 1944 under this contract amounted to 103,203,800 pounds. In April, 1945 the agreement was extended, the Canadian Government through the Meat Board undertaking to supply a minimum of 60 million pounds of Canadian beef during the calendar year of 1946. The 1946 bacon contract, or the sixth negotiated since 1939 (the fifth being a two-year agreement for 900 million pounds) provides for the shipment of at least 450 million pounds at the same prices applying in 1944-45. Because of some tendency to swing back from pigs to wheat in the Prairie Provinces, it is expected that exports of pork and pork products will decline but that this drop will be offset by an increase in fresh frozen beef and canned meat shipments. Exports of all meats in 1944 amounted to 869,000,000 pounds which was approximately one-third of Canada's total meat supply in that year and nearly half the output from inspected plants.

Canada's cheese commitment is for 125,000,000 pounds in each contract year. This quantity which amounted to 70 per cent of the total Canadian production was exported during the year ending March 31, 1945. Stocks of evaporated milk have been accumulating in Canada during the last three years, mainly because of the limitations of shipping. In order to conserve shipping space, at the request of the British in 1942, concentrated milk shipments were reduced and cheese increased. One hundred pounds of milk is concentrated to 40 pounds of evaporated product while the same amount of milk is reduced to 8 pounds of cheese. A considerable part of the stock pile of concentrated whole milk products has been

made available to UNRRA. All of it is needed, and the capacity output of our plants will still fall short of requirements. During the year 1944, approximately 30 per cent of the Canadian production of concentrated whole milk products was exported.

The export egg agreement for the calendar year 1946 was signed by the British Minister of Food and the Canadian Minister of Agriculture on April 3, 1945. The minimum requirements are 82.5 million dozen, 30 million to be shipped as dried eggs and 52.5 million in shell. In addition, the British Ministry of Food has agreed to accept any additional quantities produced either in shell or dried.

Canada's productive resources are geared for high capacity output, and, given favourable weather, it is hoped that the high record of production in 1944 can be maintained in 1945 and 1946. In 1940 Canadian urban industry swung into the manufacture of munitions, and through succeeding years immense stock piles of field guns, tanks, rifles, and ammunition were built up. When D-Day arrived on June 6, 1944, these weapons of war in the hands of men who could use them brought us victory.

Food contributed to the winning of the war, and now food will be just as important in establishing the peace as munitions and food were in fighting the war. With victory in Europe it becomes the responsibility of the United Nations to feed the liberated peoples until their own productive resources can be restored. A hungry Europe will never be a peaceful Europe. Concentrated food rations are now slowly restoring Europe's starving millions to health. The friends that Canada's fighting men have made in the liberated countries now look to us for food.

This is a critical year and will probably be the most difficult from the standpoint of food supplies and distribution in our wartime experience. Because of unfavourable weather in many crop-growing areas of the world the situation is becoming increasingly serious and may require restrictions in consuming habits to which people have not yet become accustomed. *The hard fact is, there is not enough food to go around.*

Alike . . . yet different

LIFE INSURANCE companies are much alike as to policies and rates, but actual long-term results vary widely.

We invite you to compare The Mutual Life of Canada's record with that of any other company. Evidence of the satisfaction of Mutual Life policyholders is furnished by the fact that whole families and succeeding generations have entrusted their life insurance programs exclusively to The Mutual Life, and each year approximately 35% of its new business comes from policyholders.

Have a Mutual Life representative explain the special features of this Company . . . and let him help you select a policy adapted to your particular circumstances.

**THE
MUTUAL LIFE
OF CANADA**

HEAD OFFICE • WATERLOO, ONTARIO

*Low Cost Life Insurance
Since 1869*

EDITOR'S NOTE-BOOK

John Ness was born and educated in Edinburgh, Scotland. In 1903 he joined the staff of H. M. Geological Survey, later having superintendence of its mapping division. When Imperial Oil, Limited, established a Geological Department in 1919, Mr. Ness was engaged to organize the office staff, and, after a year spent in Western Canada, carried out the duties of Assistant to the Chief Geologist in the head offices at Toronto. The growing importance of Canadian development resulted in expansion of the Lands and Leases Department, of which he was subsequently put in charge; from this assignment he recently transferred to the Department of Public Relations. Mr. Ness is a Fellow of the Geological Society of Edinburgh and a member of the Canadian Institute of Mining and Metallurgy, serving on the Council of the latter body from 1927-'31, and acting as Vice-Chairman of the Toronto Branch for some years. In 1921 he was awarded the Leonard Medal for his paper, "Search for Oil in the West".

* * *

A. A. Swinnerton, writer of "Peat in Canada", is a member of the staff of the Fuel Research Laboratories, Bureau of Mines, Ottawa. He was born in India and, after receiving his early education in England, entered the University of Toronto in 1911. After graduating in 1919, following service overseas, he was appointed to the Mines Branch of the former Department of Mines, and since then has been engaged in fuel research and investigation. In the course of his duties, he has published several reports dealing with oil shales, bitumen and related products.

* * *

Lawrence J. Burpee—See biographical sketch in C. G. J. for April, 1945.

* * *

J. Lewis Robinson—See biographical sketch in C. G. J. for March, 1945.

A Northern Paradise

GRAY ROCKS INN
ST. JOVITE, QUEBEC



GOLF... Sporty course... beautiful greens and fairways. Short walk from Inn to first green.



TENNIS... Two fast double courts. Ideally situated for a sizzling set or two and then a dip in Lake Ouimet.

GRAY ROCKS INN
ST. JOVITE, QUE.

The Cigarette of Good Taste



CORK TIPS

PLAIN ENDS

CANADIAN BANK NOTE COMPANY LIMITED

Engravers of Securities

HEAD OFFICE
224 Wellington Street
OTTAWA

360 St. James West 25 King St. West
MONTREAL TORONTO



When in **MONTREAL**

Men of affairs naturally stop at The Windsor because of its convenient location and its well-established reputation for courtesy comfort and service.

The Windsor is recognized as the proper place for business and social meetings.

THE Windsor
ON DOMINION SQUARE

J. ALDERIC RAYMOND
PRESIDENT



**THE
CANADIAN GEOGRAPHICAL
JOURNAL**

is produced by

**GAZETTE PRINTING
COMPANY LIMITED**

Specialists in

**DESIGN & TYPOGRAPHY
FINE COLOUR PRINTING
OFFSET LITHOGRAPHY
COLOUR PHOTO-ENGRAVING
DE LUXE BINDINGS**

★

1000 ST. ANTOINE STREET, MONTREAL

HARBOUR 2241

AMONGST THE NEW BOOKS

Greece

(Cambridge University Press, Macmillans, \$1.00)

This is the third of a series of British Survey handbooks on European countries two of which on Belgium and Romania were reviewed in these columns in an earlier issue. Like its predecessors, this little book is an outstanding example of concisely presented information. It covers the history, geography, economics, and politics of modern Greece and gives the reader a background of the unfortunate events which took place in Athens at the time of its liberation. Modern Greece, perhaps, has never really achieved a firmly established and stable government and the inter-war period was marked by political turmoil culminating in the rigid dictatorship of General Metaxas. When Italy invaded Greece all parties, however, rallied to their country's defence, and, when it was finally occupied by the enemy forces, the Greeks maintained a stiff attitude of non co-operation which was no doubt responsible in some measure for the policy of systematic starvation and repression which was enforced to a greater extent in Greece than in any other occupied countries.

This little book can be highly recommended.

* * *

Canadian Democracy in Action by GEORGE W. BROWN
(J. M. Dent & Sons (Canada) Ltd., Toronto, 0.60)

DR. BROWN is Professor of History at the University of Toronto, the author of several books on Canadian subjects and editor of the *Canadian Historical Review*. The present little book of one hundred and some odd pages was inspired by the need of providing a summarized exposition of our forms of government, Dominion, Provincial and Municipal, their functions and their various fields of jurisdiction which are, in fact, frequently in dispute. These are things that every citizen should know, but in which, too often, our knowledge is either sketchy, incomplete, or perhaps coloured by local or political prejudice.

Dr. Brown presents his subject clearly and concisely in terms that are equally suitable for the adolescent or the adult, and it is to be hoped that this excellent little book will be widely read both in schools and by the public generally.

P.E.P.

* * *

ERRATA — JUNE ISSUE

Hotel Tadoussac referred to on (page 257, para 2) and Manoir Richelieu (page 259, para 2) are both owned and operated by Canada Steamship Lines and *not* Canadian railways.